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ARITHMETIC

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GAGE'S EDUCATIONAL SERIES

ARITHMETIC

BOOK I

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ARITHMETIC

BOOK I

CHAPTER I

PRIMARY NUMBER WORK

NOTATION AND NUMERATION OF NUMBERS, 10 TO 100

Counting up to 10.

Count the number of windows in the school.

Count the number of seats in the first row.

Count the number of boys in the class.

Count the number of girls in the class.

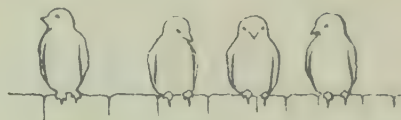
Count the number of pictures on the wall.

Take the pupils to the window and have them count the number of buildings they see.

The teacher should give the pupils practice in counting objects up to 10. Care should be taken that the pupils repeat the name of each number correctly.

NOTE. Each pupil should have a number box with objects which are easily handled for counting. Such objects as beans, spools, blocks, cones, almonds, etc., make good material.

How many birds are on the fence?



How many cows do you see in the field?



How many boys and girls are listening to the story?



How many apples are in the dish?



How many trees do you see along the road?



How many sheep are in the field?



How many horses is this man driving?



How many little chickens has this mother hen?



Reading and writing the numbers up to 10.

Have the pupils pick out from their number boxes, *one* spool; *one* block; *one* button; etc.

Give the pupils the written name and figure: *One, 1.*

Have the pupils pick out *two* spools; *two* beans; *two* rose-hips, etc.

Give the written name and figure: *Two, 2.*

Making a similar use of the objects, teach the names and figures:

Three, 3

Four, 4

Five, 5

Six, 6

Seven, 7

Eight, 8

Nine, 9

Ten, 10

1. Write on the blackboard the names of the different numbers up to ten and have the pupils count out objects from their number boxes to represent them.

2. Write on the blackboard the figures representing different numbers up to ten and have the pupils count out objects to represent them.

EXERCISE

1. Count out 3 beans; 4 spools; 5 pebbles; 8 blocks; 6 rose-hips; 9 cones; 7 nails; 10 clothes pins.

2. Count out *seven* spools; *five* beans; *eight* blocks; *six* nails; *nine* rose-hips; *three* pebbles; *four* clothes pins; *ten* cones.

3. Give the name for each of the following: 3, 5, 8, 7, 6, 10, 4, 9, 2.

4. Write the figure for each of the following: two, seven, one, five, ten, nine, four, six, eight, three.

5. Write the numbers with the names and figures on the blackboard and keep these for reference. Have individual pupils read aloud from the blackboard:

one	two	three	four	five
1	2	3	4	5
six	seven	eight	nine	ten
6	7	8	9	10

SEAT EXERCISE

1. Have the pupils draw pictures showing: 6 tents; 8 apples; 5 boys; 7 chickens; 3 spools, etc.

2. Have the pupils make various objects from plasticine. Choose exercises that will give an opportunity for applying counting in the number space up to 10.

Examples:

Make a mother hen with 7 little chickens.

Make a bird's nest with 6 eggs.

Make 5 little pigs.

3. Have the pupils make designs with colored sticks, the teacher drawing the designs on the blackboard. Have the pupils count the number of sticks used in each design, and have them write down the figures.

The following are a few specimen designs:



STAR



LADDER



HOUSE

Counting up to 25.

Provide each pupil with objects to count out the numbers from 10 to 25. Test each pupil carefully and see that he is able to count accurately any number of objects up to 25.

Reading and writing the numbers up to 25.

As the pupil grasps the numbers from 11 to 25, give the figures which represent these numbers:

11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25

Test the pupils frequently in reading the foregoing numbers at sight. The numbers should be written on the blackboard, or on a chart, and should be used for frequent drills.

EXERCISE

1. Have the pupils take out their number boxes and pick out different numbers, *e.g.* 15, 22, 17, 9, 19, 25, 18, etc.

This exercise should be given daily, until each pupil is able to count accurately any number of objects up to 25.

2. From dictation have the pupils write down the different numbers, giving them in various sequences, *e.g.* 22, 17, 9, 13, 20, 10, 24, 7, 15, 21, etc.

3. Have the pupils copy the numbers from 1 to 25.

Counting up to 50.

Reading and writing the numbers up to 50.

After the pupils know the numbers up to 25, the counting of objects up to 50 should be taken up. The figures representing the numbers from 26 to 50 should be taught.

EXERCISE

1. From the number boxes have the pupils pick out 35, 42, 29, 27, 38, 16 objects.

2. Repeat Example 1, giving a drill on all the numbers up to 50.

Give the following exercises to the pupils:

3. Write the numbers from 20 to 35.

4. Write the numbers from 31 to 50.

5. Write the numbers from 37 to 49.

6. Write from dictation:

(a) 17, 28, 35, 42, 39, 47, 41, 30

(b) 9, 20, 45, 13, 26, 34, 19, 40

(c) 7, 18, 24, 37, 49, 11, 31, 48

7. Read the following numbers :

(a) 38, 47, 29, 16, 8, 30, 43, 33

(b) 45, 23, 17, 35, 9, 20, 18, 39

(c) 10, 29, 42, 37, 15, 27, 11, 21

8. Give the names of all the numbers from 1 to 50 which end in

(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

(f) 6 (g) 7 (h) 8 (i) 9 (j) 0

9. What number comes after each of the following :

(a) 6, 17, 28, 35, 42, 39, 47, 41

(b) 9, 20, 45, 13, 26, 34, 19, 40

(c) 7, 18, 23, 37, 49, 11, 31, 48

10. What number comes before each of the following :

(a) 38, 47, 29, 16, 8, 30, 43, 33

(b) 45, 23, 17, 35, 9, 20, 18, 39

(c) 10, 29, 42, 37, 15, 27, 11, 21

STUDY OF THE NUMBERS 2 TO 10

Grouping

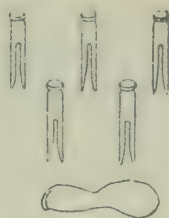
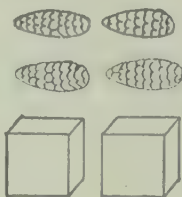
The purpose of grouping is to enable the pupil to find out the number relations of the various numbers.

The pupil counts out from his number box 2 objects ; these may be alike or may be different objects. He sees that the group *two* is made up of two *ones*. He represents this fact with the objects.

In the same way he proceeds with all the numbers to 10, arranging the various groups so as to show all the number relations contained in them.

This work should be manual and oral. The pupil should be led to discover these relations for himself.

The following are some of the groupings or number relations the pupil can make with *six* :



The pupils should be given frequent practice in grouping objects, so that they may know all of the relations of any number.

EXERCISE

1. Write on the blackboard any number or its name and have the pupils show with objects all the number relations.

2. Arrange any group of objects up to 10 and ask the pupils to tell the number stories represented. Lead the pupil to grasp the group, without counting out the separate objects composing it.

The combinations and separations of the numbers 2 to 10.

After the pupil has studied the number groups and has developed the various number relations from them, he should be given the formal work in number combinations and separations.

The Number 2

Teach:

1 2 Read 1 and 1 are 2.

1 $\begin{array}{r} -1 \\ \hline 2 \end{array}$ Read 2 take away 1 leaves 1.

2 1

The pupil should learn both the addition and the subtraction at the same time. Do not treat these as separate processes. Give frequent and thorough drills on these relations.

Oral applications.

1. One cent and one cent are how many cents?
2. Jane had 2 apples. She gave her brother 1. How many did she have left?
3. Bobbie has 1 orange. He wants 2. How many more will he have to get?
4. I gave Kate and Ralph 1 apple each. How many apples did I give to them?

The Number 3*Teach:*

1	2	3	3
$\frac{2}{3}$	$\frac{1}{3}$	$\frac{-1}{2}$	$\frac{-2}{1}$

After the pupil has discovered the number relations of *Three* from objects, write these on the blackboard. Drill the class on these relations.

Oral applications.

1. Tom had 3 colts. He sold 2. How many had he left?
2. Mary had 2 black chickens and 1 white chicken. How many chickens had she altogether?
3. On the way to school I saw 3 birds. 1 of these birds was blue, and the others were brown. How many brown birds were there?
4. I had 3 oranges, and I gave 1 to each boy in the class. How many boys were in the class?
5. Mary fed 1 calf, and her sister fed 2. How many calves did they both feed?

The Number 4*Teach:*

3	1	4	4	2	4
$\frac{1}{4}$	$\frac{3}{4}$	$\frac{-3}{1}$	$\frac{-1}{3}$	$\frac{2}{4}$	$\frac{-2}{2}$

Oral drill on the combinations.

1. 3 and what are 4? 1 and what are 4?
2. What are 2 and 2? 3 and 1?
3. How many twos are in 4?
4. How many threes are in 4? Answer 1 three and 1 over.

Oral applications.

1. John bought 4 papers and sold 2 of them. How many had he left?
2. Mary had 3 words right and 1 word wrong in spelling. How many words were there to spell?
3. Leslie has 1 sister and 3 brothers. How many brothers and sisters has he altogether?
4. In a bird's nest 3 eggs hatched into little birds, and 1 egg did not. How many eggs were in the nest at first?
5. I was given 4 story books for Christmas. I read 1 of them. How many have I yet to read?
6. What are the answers:
 - 3 and 1? 2 take away 1? 4 take away 3?
 - 1 and 2? 2 and 2? 2 and 1?
 - 1 and 3? 4 take away 1?
 - How many twos are in 4?
 - How many threes are in 4?
 - How many twos are in 3?

7. Give the answers at sight :

2	4	3	1	3	4	3	2
<u>1</u>	<u>-2</u>	<u>-1</u>	<u>1</u>	<u>1</u>	<u>-3</u>	<u>-2</u>	<u>2</u>

The Number 5

Teach :

				<u>2</u>				
4	1	2	3	2	5	5	5	5
<u>1</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>-3</u>	<u>-2</u>	<u>-4</u>	<u>-1</u>
<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>4</u>

Oral drill on the combinations.

1. 3 and what are 5? 2 and what are 5?
2. What are 4 and 1? 3 and 2?
3. 5 take away 4 are how many?
5 take away 2 are how many?
4. What are 2 and 2 and 1?
5. How many twos are in 5?
6. How many threes are in 5?

Oral applications.

1. Mary received 5 dolls for Christmas. She gave 2 of them to a friend. How many did she have left?
2. Fred has 4 white rabbits and 1 brown one. How many rabbits has he?
3. John had 2 cents. He did an errand for his father who gave him 2 cents, and he was given 1 cent by his brother. How many cents did he then have?
4. Katie had 5 oranges. She gave 1 to Anne. How many did she have left?
5. On Monday Clara learned 3 new words, and on Tuesday she learned 2 new words. How many new words did she learn in these two days?

6. Give the answers at sight :

3	3	5	3	2	4	¹ 2	5	5	1
<u>2</u>	<u>1</u>	<u>-3</u>	<u>-2</u>	<u>2</u>	<u>-1</u>	<u>2</u>	<u>-4</u>	<u>-2</u>	<u>4</u>

The Number 6

Teach :

5	1	6	6	4	2	6	6	3	6	² 2
<u>1</u>	<u>5</u>	<u>-5</u>	<u>-1</u>	<u>2</u>	<u>4</u>	<u>-4</u>	<u>-2</u>	<u>3</u>	<u>-3</u>	<u>2</u>
6	6	1	5	6	6	2	4	6	3	6

Oral drill on the combinations.

Give the answers :

1. 1 and 5; 3 and 3; 6 take away 3
2. 6 take away 1; 4 and 2; 6 take away 4
3. 2 and 2 and 2; 6 take away 2
4. How many twos are in 6?
5. How many threes are in 6?
6. How many fours are in 6?
7. How many fives are in 6?

Oral applications.

1. Mother had 6 eggs. She cooked 3 of them for breakfast. How many are left?
2. John had 5 cents. He earned 1 cent. How many cents did he then have?
3. Katie had 6 apples. She gave 4 of them away. How many had she left?
4. Mother gave 2 plums to Mary, 2 plums to Annie, and 2 plums to Bob. How many plums did she give to the 3 children?

9. What are 2 threes and 1?
 10. What are 3 twos and 1?

Oral applications.

1. I had 5 black chickens and 2 white chickens. How many chickens did I have altogether?
 2. There are 7 days in a week. Tom goes to school 5 days. How many days does he stay at home?
 3. Mary had a party. She invited 4 girls and 3 boys. How many children were invited to the party?
 4. There were 7 robins on the lawn. 6 of them flew away. How many were left?
 5. Harvey had 7 cents. He bought a ball which cost him 5 cents. How much money did he have left?

6. Give the answers at sight :

								3	
3	5	4	7	5	2	6	7	3	3
2	<u>2</u>	<u>2</u>	<u>-3</u>	<u>-2</u>	<u>1</u>	<u>-3</u>	<u>-5</u>	<u>1</u>	<u>4</u>

7. What are 3 twos? 2 threes?
 8. What are 1 five and 2 more?
 9. What are 3 twos and 1 more?
 10. What are 1 four and 3 more?
 11. What are 2 and 3 and 2?

The Number 8

Teach:

									2							
									3	2						
7	1	8	8	6	2	8	8	4	8	3	2	5	3	8	8	
<u>1</u>	<u>7</u>	<u>-7</u>	<u>-1</u>	<u>2</u>	<u>6</u>	<u>-2</u>	<u>-6</u>	<u>4</u>	<u>-4</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>5</u>	<u>-5</u>	<u>-3</u>	
8	8	1	7	8	8	6	2	8	4	8	8	8	8	3	5	

Oral drill on the combinations.

Give the answers :

1. 6 and 2 ; 7 and 1 ; 8 take away 6.
2. 5 and 3 ; 8 take away 4 ; 8 take away 3.
3. 4 and 4 ; 2 and 3 and 3 ; 8 take away 7.
4. 2 and what are 8? 4 and what are 8?
5. 3 and what are 8? 8 take away 2?
6. How many twos are in 8? How many threes are in 8? How many fours are in 8?
7. What are 2 and 1 and 5?
8. What are 3 and 4 and 1?

Oral applications.

1. Mary had 6 oranges and was given 2 more. How many oranges had she then?
2. John had 4 cents. His father gave him 2 cents, and his mother gave him 2 cents. How many cents had he then?
3. Jessie had 8 cents. She bought a book costing 5 cents. How many cents had she left?
4. Elsie wrote 8 words in her book. 1 of these was wrong. How many words were right?
5. Tom had a party. He had 8 apples and gave 2 to each boy at the party. How many boys were at the party?
6. Give the answers at sight:

					2			3	
5	8	7	6	4	3	6	8	2	7
3	<u>-4</u>	<u>-5</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>-5</u>	<u>-2</u>	3	-3

7. How many sixes are in 8?
8. How many threes are in 8?
9. How many sevens are in 8?
10. How many fives are in 8?

The Number 9

Teach :

8	1	9	9	7	2	9	9	6	3	9	9	5	4	9	9	3	3
1	8	-8	-1	2	7	-7	-2	3	6	-6	-3	4	5	-5	-4	3	
9	9	1	8	9	9	2	7	9	9	3	6	9	9	4	5	9	

Oral drill on the combinations.

Give the answers :

1. What are 7 and 2? 6 and 3?
2. 5 and what are 9? 2 and what are 9?
3. 9 take away 3 are how many?
4. What are 4 and 4 and 1? What are 3 threes?
5. What are 4 and 3? What are 5 and 4?
6. If we take 3 from 9, how many are left?
7. What are 3 twos and 1? What are 4 twos and 1?
8. How many threes are in 9?
9. How many twos are in 9?
10. How many fours are in 9?

Oral applications.

1. Mary had 6 cents, and her mother gave her 3 cents. How many cents has she now?

2. Bobbie and Tom are playing soldiers. Bobbie has 9 soldiers, and Tom has 5. How many more soldiers has Bobbie than Tom?

3. Mary and Lucy were hunting birds' nests. Mary found 7, and Lucy found 2. How many did they both find?

4. Katie had a party with 4 friends. Each friend was given 2 dishes of ice cream, and Katie was given 1 dish. How many dishes of ice cream were there?

5. Stuart had 9 peanuts. He ate 4 of them. How many did he have left?

6. Mother gave 3 candies to each of her 3 children. How many candies did she give altogether?

7. Give the answers at sight :

3						4			
3	9	8	4	5	3	9	2	2	8
2	<u>-7</u>	<u>-2</u>	<u>3</u>	<u>4</u>	<u>2</u>	<u>-6</u>	<u>3</u>	<u>6</u>	<u>-3</u>
8	7	3	2	4	1	6	5	4	3
<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>
9	8	7	9	7	8	9	7	9	8

8. How many twos are in 9?

How many threes are in 8?

How many fours are in 7?

How many threes are in 7?

How many fours are in 9?

9. What are 2 fours and 1 more?

What are 3 twos and 3 more?

What are 1 six and 2 more?

What are 1 five and 4 more?

What are 4 twos and 1 more?

The Number 10

Teach :

9	1	10	10	8	2	10	10	7	3
<u>1</u>	<u>9</u>	<u>-9</u>	<u>-1</u>	<u>2</u>	<u>8</u>	<u>-2</u>	<u>-8</u>	<u>3</u>	<u>7</u>
10	10	1	9	10	10	8	2	10	10
								2	
								2	
								2	
10	10	6	4	10	10	5	10	2	
<u>-7</u>	<u>-3</u>	<u>4</u>	<u>6</u>	<u>-6</u>	<u>-4</u>	<u>5</u>	<u>-5</u>	<u>2</u>	
3	7	10	10	4	6	10	5	10	

Oral drill on the combinations.

Give the answers :

1. What are 6 and 4? 5 and 4? 7 and 3?
2. What are 4 and 5? 2 and 7? 3 and 4?
3. 5 and what are 10? 7 and what are 9?
4. 6 and what are 10? What are 8 and 1?
5. 2 and what are 10? 7 and what are 10?
6. What are 2 and 4 and 3?
7. What are 3 and 4 and 3?
8. What are 10 take away 8? 10 take away 6? 10 take away 5?
9. How many fives are in 10? How many twos are in 10?
10. How many are 4 twos? 3 twos? 5 twos? 3 threes? 2 fives?

Oral applications.

1. John had 10 cents. He spent 2 cents for a book and 5 cents for a pencil. How many cents had he left?
2. Mary had a party. She invited 5 boys and 4 girls. How many were invited to the party?
3. Mary walked 3 blocks to school and 4 blocks farther to the store. How far did she walk altogether?
4. Mary has 3 dolls, Lucy has 4 dolls, and Kate has 2 dolls. How many dolls have the 3 girls?
5. Rob had 10 rabbits. He sold 4 of them. How many has he left?
6. Harry has 3 pigeons. He bought 7 more. How many has he now?
7. Edgar wrote 10 words in his book. 2 of these words were wrong. How many words were right?

8. Give the answers at sight :

		5		4			2			
6	8	3	10	4	9	3	3	10	5	10
<u>3</u>	<u>2</u>	<u>1</u>	<u>-7</u>	<u>2</u>	<u>-5</u>	<u>5</u>	<u>2</u>	<u>-6</u>	<u>5</u>	<u>-9</u>

9. How many twos are in 10?

How many threes are in 10?

How many fives are in 10?

How many fours are in 10?

How many sevens are in 10?

10. What are 3 threes and 1 more?

What are 2 fours and 1 more?

What are 1 five and 4 more?

What are 4 twos?

Counting up to 100.

Reading and writing the numbers up to 100.

After the pupils know the numbers to 50, they should be taught to count, read, and write the numbers from 50 to 100.

EXERCISE

1. Count from 50 to 60; 60 to 70; 70 to 80; 80 to 90; 90 to 100.

2. Write the numbers from 51 to 65.

3. Write the numbers from 60 to 83.

4. Write the numbers from 74 to 100.

5. Write from dictation :

(a) 53, 67, 95, 86, 79.

(b) 58, 92, 64, 85, 77.

(c) 99, 68, 87, 51, 70.

6. Write all the numbers ending in 0 between 10 and 100.

7. Write all the numbers ending in 3 between 23 and 53.

8. Write all the numbers ending in 7 between 47 and 87.
9. Write all the numbers ending in 9 between 69 and 99.
10. Write all the numbers ending in 1 between 1 and 100.

Review of the Numbers up to 10

TO THE TEACHER. — Frequent oral drills should be given to the pupils on the number relations up to 10. The pupils should give the results rapidly. Drill should be given daily, the teacher varying the exercises. The following exercises are suggestive:

Give the answers at sight:

$$\begin{array}{cccccccccccccc} 1. & 2 & 3 & 4 & 5 & 7 & 6 & 3 & 7 & 8 & 4 & 9 & 3 & 1 \\ & \underline{5} & \underline{6} & \underline{4} & \underline{2} & \underline{3} & \underline{2} & \underline{5} & \underline{2} & \underline{2} & \underline{3} & \underline{1} & \underline{3} & \underline{6} \end{array}$$

$$\begin{array}{cccccccccccccc} 2. & 10 & 9 & 7 & 6 & 8 & 3 & 7 & 5 & 9 & 8 & 5 & 10 \\ & \underline{-7} & \underline{-3} & \underline{-4} & \underline{-2} & \underline{-5} & \underline{-1} & \underline{-4} & \underline{-2} & \underline{-7} & \underline{-6} & \underline{-1} & \underline{-8} \end{array}$$

$$\begin{array}{cccccccccccccc} 3. & 2 & 5 & 7 & 3 & 6 & 4 & 3 & 5 & 8 & 3 & 4 & 6 & 2 \\ & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} & \underline{?} \\ & 9 & 8 & 10 & 7 & 10 & 9 & 9 & 7 & 10 & 6 & 10 & 8 & 10 \end{array}$$

4. Add:

$$\begin{array}{cccccccccc} & & & & 1 & 3 & 4 & 4 & 5 & 2 \\ 2 & 3 & 4 & 3 & 5 & 2 & 3 & 0 & 2 & 1 \\ 4 & 3 & 1 & 4 & 2 & 3 & 0 & 3 & 0 & 2 \\ 3 & 4 & 3 & 2 & 1 & 2 & 1 & 2 & 3 & 4 \end{array}$$

5. *The teacher dictates, and the pupils do the work mentally:*

- (a) 4, add 5, take away 2, add 3, take away 6.
- (b) 2, add 3, add 4, take away 5, add 3, take away 7.
- (c) 10, take away 8, add 5, add 2, take away 6.
- (d) 9, take away 2, take away 3, add 5, take away 6, take away 1, add 8.
- (e) 10, take away 3, take away 2, add 5, take away 6, add 3.

6. 3 and what are 10? 7 and what are 9?
 5 and what are 9? 6 and what are 8?
 2 and what are 7? 4 and what are 7?
 4 and what are 10? 1 and what are 9?
 6 and what are 9? 3 and what are 8?
7. How many twos are in : 5, 8, 9, 10, 7, 6?
 How many threes are in : 7, 10, 9, 8, 4, 6, 5?
 How many fours are in : 6, 9, 8, 10, 7, 5?
 How many fives are in : 10, 9, 7, 6, 8?
 How many sixes are in : 9, 8, 6, 7, 10?
 How many sevens are in : 10, 9, 8, 7?
8. What are 2 threes and 4 more?
 What are 5 twos?
 What are 4 twos and 1 more?
 What are 2 threes and 3 more?
 What are 1 seven and 2 more?
 What are 1 six and 4 more?

9. Add the columns at sight :

2		1		4	2				
0	4	0	1	2	1	3		3	2
1	2	5	3	4	0	2	2	2	4
3	4	3	3	1	2	0	3	3	0
<u>2</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>4</u>	<u>2</u>	<u>3</u>

10. Subtract at sight :

8	9	7	8	10	9	8	10	9	10
<u>-4</u>	<u>-3</u>	<u>-2</u>	<u>-5</u>	<u>-7</u>	<u>-4</u>	<u>-2</u>	<u>-6</u>	<u>-2</u>	<u>-3</u>

ORAL EXERCISE

1. Mary is 9 years old. Her brother Harry is 4 years younger. How old is Harry?

2. A man sold 5 turkeys to one man and 3 turkeys to another. How many turkeys did he sell to both?

3. On one bush there are 4 roses, on another 2, and on another 3. How many roses are there on the three bushes?

4. Tom has 4 marbles in one pocket and 3 marbles in another pocket. How many marbles has he in both pockets?

5. Mary has a chicken that weighs 4 pounds. Lucy has a chicken that weighs 6 pounds more. How much does Lucy's chicken weigh?

6. Betty bought a book for 5 cents and a pencil for 3 cents. She gave the storekeeper a 10-cent piece. How much change did she receive?

7. Harold rode 9 miles in a motor car, and Jack rode 7 miles. How much farther did Harold ride than Jack?

8. Arthur earned 3 dollars in April, 2 dollars in May, and 4 dollars in June. How much did he earn during the 3 months?

9. A man has to walk 8 miles. He has already walked 3 miles. How much farther has he to go?

10. Four girls gave money to the Red Cross. Ethel gave 2 dollars, Beth gave 3 dollars, Kate gave 2 dollars, and Jane gave 3 dollars. How much did they give altogether?

Review

The teacher should test the pupils to find how many correct results each one can give in 10 minutes, 5 minutes, 1 minute.

1.	4	6	2	1	5	4	9	2	1	3
	<u>3</u>	<u>2</u>	<u>7</u>	<u>8</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>5</u>	<u>6</u>	<u>7</u>

2.	5	4	5	2	9	3	3	2	7	4
	<u>5</u>	<u>3</u>	<u>2</u>	<u>7</u>	<u>1</u>	<u>6</u>	<u>5</u>	<u>3</u>	<u>3</u>	<u>4</u>

3.	3	2	5	3	7	4	1	3	5	5
	<u>7</u>	<u>6</u>	<u>4</u>	<u>4</u>	<u>2</u>	<u>6</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>3</u>

4.	6	9	5	10	9	8	10	8	8	10
	<u>-3</u>	<u>-2</u>	<u>-4</u>	<u>-1</u>	<u>-5</u>	<u>-6</u>	<u>-2</u>	<u>-3</u>	<u>-1</u>	<u>-7</u>

5.	7	7	10	9	8	9	10	7	9	10
	<u>-3</u>	<u>-1</u>	<u>-7</u>	<u>-3</u>	<u>-4</u>	<u>-2</u>	<u>-6</u>	<u>-2</u>	<u>-8</u>	<u>-5</u>

6.	9	8	7	6	2	3	1	5	6	2
	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>
	10	10	9	8	7	9	8	7	10	7

7.	3	1	3	6	2	2	4	2	3	4
	1	2	3	1	1	4	2	6	4	2
	<u>5</u>	<u>4</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>1</u>	<u>3</u>	<u>2</u>

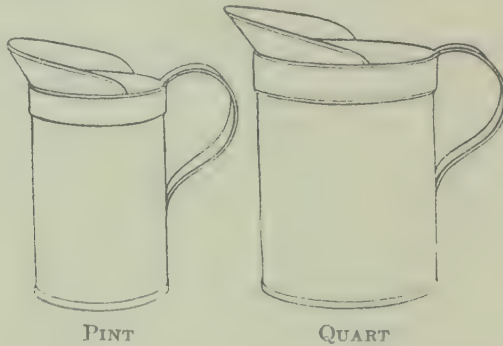
8.										1
	2	2	3	1	1	4	3	3	4	2
	1	5	2	4	6	5	5	3	2	3
	<u>4</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>3</u>

MEASURING

The teacher should be provided with a pint and a quart measure. Ask the pupils to fill the quart measure with water, using the pint measure. Reverse the process. Fill the quart measure with water and have the pupils pour it into the pint measure, finding out how many pints are in the quart.

Teach:

In 1 quart there are 2 pints.

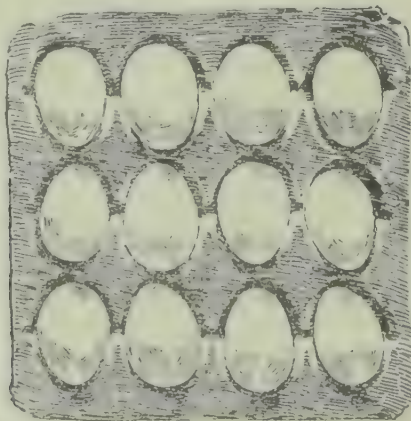


The teacher should have the pupils count out 12 pencils, 12 brushes, 12 blocks, 12 cones, etc.

Give the name *dozen*.

Teach:

In 1 dozen there are 12 things.



1 DOZEN

Have the pupils count the number of days in the week and the number of months in the year. Also have each pupil count the number of inches on his foot ruler.

Teach:

In 1 week there are 7 days.

In 1 year there are 12 months.

In 1 foot there are 12 inches.

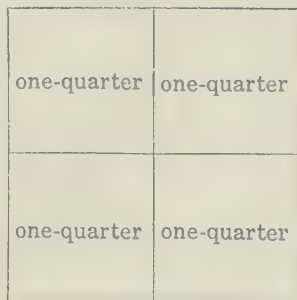
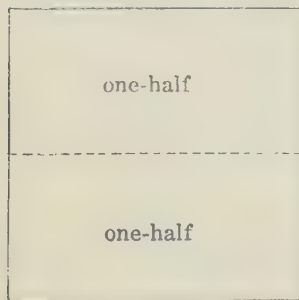
ONE-HALF AND ONE-QUARTER

Take a square piece of paper and fold it evenly across *once* so that the edges meet. Now unfold the paper. We see that the paper is marked off into 2 parts, and that each part is the same size. The paper is divided into 2 equal parts. We call each of these equal parts *one-half*.

Give the pupils practice in folding squares and circles, so as to develop the idea of dividing any object into 2 equal parts, or taking *one-half* of it.

Take a square piece of paper and fold it evenly across so that the edges meet. Now fold it again so that the sides meet. Now unfold the paper. We see that the paper is marked off into 4 parts, and that each part is the same size. The paper is divided into 4 equal parts. We call each of these equal parts *one-quarter* or *one-fourth*.

Give the pupils practice in folding squares and circles, so as to develop the idea of dividing any object into 4 equal parts, or taking *one-quarter* of it.



TELLING TIME

On clocks and watches letters are often used instead of figures in writing the numbers from 1 to 12.

I is used for 1.

VII is used for 7.

II is used for 2.

VIII is used for 8.

III is used for 3.

IX is used for 9.

IIII is used for 4.

X is used for 10.

V is used for 5.

XI is used for 11.

VI is used for 6.

XII is used for 12.

1. Give the name of each of the following numbers :

V	III	IX	XII	IIII	VIII
II	XI	VI	X	VII	I

NOTE TO THE TEACHER. -- The teacher should represent with a piece of cardboard the face of a clock with movable hands.

Read the numbers on the clock face.

Point out 9, 7, 6, 3, 12, 1, 10, 8, 5, 4, 2, and 11.

The long hand on the clock is called the *minute hand*.

The short hand on the clock is called the *hour hand*.



When the minute hand points to XII and the hour hand points to IX, it is 9 o'clock.

When the minute hand points to XII and the hour hand points to VI, it is 6 o'clock.

Illustrate by moving the hour hand : 2 o'clock ; 4 o'clock ; 8 o'clock ; 7 o'clock ; 11 o'clock ; 5 o'clock ; 10 o'clock ; 3 o'clock ; 12 o'clock.

Show the pupils that the minute hand travels all the way round the clock every hour. Then show them that when the minute hand has moved from 12 to 6, the hour hand has moved half a space. The time is half past.

Illustrate with the clock face: half past 9; half past 3; half past 8, etc.

By means of the clock face give the pupils practice in reading the half hour.

If the minute hand travels from XII to III, it has gone one-fourth around the clock. We say that the time is a quarter past.

Illustrate with the clock face: a quarter past 9; a quarter past 12; a quarter past 3, etc.

By means of the clock face give the pupils practice in reading the quarter past.

If the minute hand has travelled from XII to IX, it has to go from IX to XII to complete the hour. That is, it is a quarter to the next hour.

Illustrate with the clock face: a quarter to 8; a quarter to 4; a quarter to 12; a quarter to 9; a quarter to 5; a quarter to 3, etc.

By means of the clock face give the pupils practice in reading the quarter to.

EXERCISE

Using the clock face, show the following times and have the pupils tell the time in each case:

1. Six o'clock; 3 o'clock; 12 o'clock.
2. Half past 7; a quarter past 5; a quarter to 9; half past 8.
3. A quarter to 3; half past 6; 11 o'clock; a quarter past 6; half past 10.

Continue such exercises until the pupils are familiar with reading the time.

EXERCISE

Using a foot ruler, have the pupils do the following:

1. Draw a line 6 inches long.
2. Draw a line 4 inches long.
3. Draw a line 8 inches long.
4. Draw a line 5 inches long.
5. Draw a line 10 inches long.

Cut off a strip of cardboard 1 inch long. With this 1 inch of cardboard as a ruler, have each pupil find:

6. The number of inches in the length of his reader.
7. The number of inches in the length of his pencil.
8. The number of inches in the length of a piece of chalk.
9. The number of inches in the length of his desk.
10. The number of inches in the length of his note-book.

Oral.

11. On Monday Mary's mother bought 4 quarts of milk. If the milkman gave her the milk in pint bottles, how many bottles did she get?

12. Arthur bought the ice cream for a picnic. He bought 3 pints of strawberry ice cream, 3 pints of chocolate ice cream, and 2 pints of vanilla ice cream. How many quarts of ice cream did he buy?

13. Betty began to attend school on the first day of February and attended every day until the last day of June. How many months did she go to school?

14. Jack bought 3 apples, Robert bought 5 apples, and Harold 2 apples. They divided the apples equally among 5 boys. How many apples did each boy receive?

15. Tom sells milk. On Monday he sold 3 pints, on Tuesday 2 pints, on Wednesday 4 pints, and on Thursday 1 pint. How many quarts of milk did he sell?

CHAPTER II

NOTATION, NUMERATION, ADDITION, SUBTRACTION

NOTATION AND NUMERATION OF NUMBERS, 100 TO 1000

The numbers above 100 are 101, 102, 103, and so on to 199.

After 199 the next number is 200, then follow 201, 202, 203, etc. to 299.

After 299 comes 300.

The other hundred numbers are 400, 500, 600, 700, 800, 900.

After 999 comes 1000.

Drill on recognition of the numbers up to 1000.

Write from dictation :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	537	629	758	339	206
2.	720	219	507	483	365
3.	983	802	797	685	222
4.	600	250	570	813	206
5.	410	900	730	675	444

Write the following numbers :

6. The 5 numbers following 309.
7. The 6 numbers following 827.
8. The 10 numbers following 240.
9. The 5 numbers before 734.
10. The 10 numbers before 603.

Write the following numbers :

11. All the numbers from 275 to 375.
12. All the numbers from 483 to 583.
13. All the numbers from 792 to 825.
14. All the numbers before 350 down to 280.
15. All the numbers before 815 down to 750.

Read the following numbers aloud :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
16.	777	307	202	700	560
17.	983	540	606	652	440

Write in figures :

18. One hundred thirty-seven.
19. Four hundred nineteen.
20. Eight hundred seven.
21. Three hundred seventy.
22. Ninety-six.
23. Seven hundred eleven.
24. Nine hundred ninety.
25. Five hundred ninety-two.
26. Two hundred two.

Units and Tens

Introductory.

Count out 10 sticks, 20 sticks, 15 sticks, 26 sticks, 17 sticks. Put these in separate piles.

From the pile of 17 sticks count out 10. Tie these in a bundle. In 17 sticks there is 1 bundle of 10 sticks and 7 sticks over. Similarly with 26 sticks there are 2 bundles of 10 and 6 sticks over.

In 15 sticks there is 1 bundle of 10 and 5 sticks over.

In 20 sticks there are 2 bundles of 10 and 0 over.

In 10 sticks there is 1 bundle of 10 and 0 over.

Write down 17, 26, 15, 20, and 10.

Consider 17.

What does the 7 represent? Answer, 7 ones.

What does the 1 represent? Answer, 1 ten.

We see then that 17 is made up of 2 figures, the right-hand figure standing for *ones* or *units* and the left-hand figure standing for *tens*.

Consider 26.

The 6 stands for 6 units or ones and the 2 for 2 tens.

In writing numbers from 10 to 99 we require 2 figures. The right-hand figure is called the units figure. The figure to the left of the units is called the tens figure.

EXERCISE

(Give the units figure and the tens figure in each of the following :

1. 37	59	63	87	22
2. 19	80	79	33	50
3. 53	75	97	46	66

Write from dictation, placing the units figures under units figures and tens figures under tens figures, the following :

4. 38	50	21	17	99
5. 37	26	52	36	90

State the number of units and tens in each of the numbers in Examples 4 and 5.

Write the following numbers with figures and write the number of units and tens in each :

Example: Forty-six, $46 = 4$ tens 6 units.

6. Seventy-five; thirty-nine; sixty.
7. Thirty-one; ninety-five; fifty-five.
8. Sixty-three; twenty-seven; eighty.
9. Nineteen; seventy-seven; thirty-seven.
10. Thirteen; eighty-one; forty-four.

Write the numbers made up of the following units and tens:

11. 5 tens 4 units; 8 tens 8 units.
12. 6 tens 0 units; 3 tens 7 units.
13. 1 ten 9 units; 9 tens 1 unit.
14. 2 tens 8 units; 8 tens 0 units.
15. 7 tens 7 units; 4 tens 0 units.

Addition up to 20

Teach:

10	10	10	10	10	10	10	10	10	10
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
11	12	13	14	15	16	17	18	19	20
11	12	13	14	15	16	17	18	19	20
<u>-1</u>	<u>-2</u>	<u>-3</u>	<u>-4</u>	<u>-5</u>	<u>-6</u>	<u>-7</u>	<u>-8</u>	<u>-9</u>	<u>-10</u>
10	10	10	10	10	10	10	10	10	10

Oral drill on number relations.

1. What are 10 and 2? 10 and 5? 10 and 7?
2. What are 10 and 6? 10 and 9? 10 and 5?
3. 10 and what are 19? are 15? are 12?
4. 10 and what are 13? are 17? are 14?
5. What are 19 take away 9?
What are 16 take away 10?
What are 12 take away 2?

6. What are 2 and 5 and 3 and 7?
 What are 4 and 3 and 2 and 1 and 8?
 What are 3 and 5 and 2 and 6?
 What are 2 and 6 and 2 and 4?
 What are 5 and 4 and 1 and 3?

Oral applications.

1. A boy had 9 cents and earned 10 cents more. How much had he then?
2. A girl had 17 oranges. She sold 7 of them. How many did she have left?
3. Kate made 6 pies for Christmas, and Mary made 10 pies. How many pies did both make?
4. Charles had 15 cents. He spent 10 cents for a book. How much did he have left?
5. On Monday Robert sold 5 papers, on Tuesday 4 papers, on Wednesday 1 paper, and on Thursday 7 papers. How many papers did he sell altogether?

6. Give at sight the following :

									7
5	7					6	3	9	1
1	4	3	8	9	4	3	2	5	3
6	2	5	3	4	8	3	6	2	4
<u>3</u>	<u>4</u>	<u>5</u>	<u>7</u>	<u>6</u>	<u>2</u>	<u>4</u>	<u>2</u>	<u>3</u>	<u>2</u>

7. Give at sight :

10	17	13	9	16	19	15	14	8	18
<u>-5</u>	<u>-7</u>	<u>-10</u>	<u>-5</u>	<u>-10</u>	<u>-9</u>	<u>-10</u>	<u>-10</u>	<u>-3</u>	<u>-8</u>

8. Add :

2 and 8 and 7 ; 3 and 7 and 5.

5 and 5 and 3 ; 4 and 6 and 8 ;

4 and 2 and 4 and 9 ; 5 and 2 and 3 and 6.

Teach:

$$\begin{array}{r} 9 \quad 2 \quad 11 \quad 11 \quad 3 \quad 8 \quad 11 \quad 11 \\ 2 \quad 9 \quad -9 \quad -2 \quad 8 \quad 3 \quad -3 \quad -8 \\ \hline 11 \quad 11 \quad 2 \quad 9 \quad 11 \quad 11 \quad 8 \quad 3 \end{array}$$

$$\begin{array}{r} 7 \quad 4 \quad 11 \quad 11 \quad 5 \quad 6 \quad 11 \quad 11 \\ 4 \quad 7 \quad -7 \quad -4 \quad 6 \quad 5 \quad -5 \quad -6 \\ \hline 11 \quad 11 \quad 4 \quad 7 \quad 11 \quad 11 \quad 6 \quad 5 \end{array}$$

Sometimes we write 9

$$\begin{array}{r} 2 \text{ as } 9+2=11. \text{ Read 9 and 2 are 11} \\ 11 \end{array}$$

and 11

$$\begin{array}{r} -2 \text{ as } 11-2=9. \text{ Read 11 take away 2 are 9.} \\ 9 \end{array}$$

Oral drill on number relations.

1. Give the answers:

$$5+6 \quad 3+8 \quad 10+1 \quad 11-4 \quad 11-6 \quad 11-9$$

2. What are

$$11-5? \quad 11-3? \quad 11-2? \quad 11-9? \quad 11-6? \quad 11-4?$$

3. 3 and what are 11? 5 and what are 11?

2 and what are 11? 7 and what are 11?

4. Subtract:

$$\begin{array}{r} 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \quad 11 \\ -5 \quad -2 \quad -7 \quad -8 \quad -6 \quad -9 \quad -3 \quad -4 \end{array}$$

5. Give the following results:

$$2+3+4+2$$

$$4+3+4$$

$$2+6+3$$

$$11-9$$

$$5+2+3+7$$

$$3+2+4+1+6$$

Oral applications.

1. John had 11 cents. He spent 7 cents for fruit. How much had he left?

2. Mary spent 8 cents for a book and 3 cents for a pencil. How much did she spend for both?

3. Tom had 11 pigs. He sold 5 of them. How many pigs had he left?

4. Betty went to school 19 days in one month. She drove 10 days and walked the other days. On how many days did she walk to school?

5. Stuart had 8 words right in spelling and 3 words wrong. How many words was he given to spell?

6. Give at sight:

			2				
			2				
11	4	19	5	11	11	11	11
<u>-5</u>	<u>7</u>	<u>-9</u>	<u>2</u>	<u>-9</u>	<u>-6</u>	<u>-8</u>	<u>-2</u>

7. Add and subtract:

a. $4+5-3+2+2-5+3+2=$

b. $5+3-4+6+7=$

c. $4+6-3+4=$

d. $5+4-2+3+7=$

e. $2+9-3+2+9=$

*Addition by Endings.**Introductory.*

Compare the following relations:

$$\begin{array}{r} 3 \\ 4 \end{array} \quad \begin{array}{r} 13 \\ 14 \end{array}$$

$$\begin{array}{r} 1 \\ 4 \end{array} \quad \begin{array}{r} 1 \\ 14 \end{array}$$

$$\begin{array}{r} 1 \\ 4 \end{array} \quad \begin{array}{r} 1 \\ 14 \end{array}$$

$$\begin{array}{r} 2 \\ 4 \end{array} \quad \begin{array}{r} 12 \\ 14 \end{array}$$

$$\begin{array}{r} 2 \\ 4 \end{array} \quad \begin{array}{r} 12 \\ 14 \end{array}$$

$$\begin{array}{r} 2 \\ 4 \end{array} \quad \begin{array}{r} 12 \\ 14 \end{array}$$

$$\begin{array}{r} 4 \\ 6 \end{array} \quad \begin{array}{r} 14 \\ 16 \end{array}$$

$$\begin{array}{r} 4 \\ 6 \end{array} \quad \begin{array}{r} 14 \\ 16 \end{array}$$

$$\begin{array}{r} 4 \\ 6 \end{array} \quad \begin{array}{r} 14 \\ 16 \end{array}$$

In this way we may give the sum of many numbers.

Teach:

11	12	11	12	13	11	14	13	12
<u>1</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>3</u>
<u>12</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>14</u>	<u>14</u>	<u>15</u>	<u>15</u>	<u>15</u>

11	15	14	13	12	11	16	15	14
<u>4</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>1</u>	<u>2</u>	<u>3</u>
<u>15</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>17</u>	<u>17</u>	<u>17</u>

13	12	11	17	16	15	14	13	12
<u>4</u>	<u>5</u>	<u>6</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
<u>17</u>	<u>17</u>	<u>17</u>	<u>18</u>	<u>18</u>	<u>18</u>	<u>18</u>	<u>18</u>	<u>18</u>

11	18	17	16	15	14	13	12	11
<u>7</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
<u>18</u>	<u>19</u>	<u>19</u>	<u>19</u>	<u>19</u>	<u>19</u>	<u>19</u>	<u>19</u>	<u>19</u>

19	18	17	16	15	14	13	12	11	10
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>

Oral drill on number relations.

1. Add:

15	17	13	16	11	12	14	15
<u>3</u>	<u>2</u>	<u>4</u>	<u>3</u>	<u>8</u>	<u>5</u>	<u>4</u>	<u>4</u>

2. Subtract:

19	15	16	18	17	19	16	13
<u>-7</u>	<u>-2</u>	<u>-4</u>	<u>-3</u>	<u>-4</u>	<u>-6</u>	<u>-11</u>	<u>-2</u>

3. Give at sight:

15	16	11	14	19	17	12	14
<u>3</u>	<u>-2</u>	<u>8</u>	<u>5</u>	<u>-2</u>	<u>-10</u>	<u>6</u>	<u>5</u>

4. Add :

					1		
5		4	6	4	1	5	2
3		5	2	3	2	4	4
2	4	2	1	4	5	2	2
3	3	2	5	1	4	5	1
3	5	4	1	3	3	1	4
4	5	2	3	2	3	2	5

5. Add and subtract :

$$5+3+2-7+4+2+1+5+4-3=$$

$$4+6+7-5+4+3-7=$$

$$7+3+9-6+4-5+6=$$

$$4+4+2+8-5+3-6+7=$$

$$5+5+4+5-7+4+2-7=$$

Oral applications.

1. Mary had 15 cents. Her father gave her 4 cents more. How much did she then have?

2. Edgar earned 7 cents on Monday, 3 cents on Wednesday, and 9 cents on Saturday. How much did he earn altogether?

3. John has to go 16 miles to town. After he has gone 12 miles, how much farther has he to go?

4. Kate is 12 years old. In how many years will she be 19 years old?

5. I cut a pole into 2 pieces. One piece is 11 feet long, and the other piece is 7 feet long. How long was the pole?

6. There are 16 children in the class, and 10 are girls. How many boys are in the class?

Tests in Addition.

Add at sight. See how many columns the pupils can add in 10 minutes and in 5 minutes.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.				3	6	1	5.			1		
	1	4	5	4	1	5		2	5	2		
	7	5	3	1	2	3		4	3	3	7	8
	2	4	4	2	3	2		1	1	2	1	3
	3	4	3	5	3	4		5	2	5	6	2
	5	2	3	2	1	4		3	6	4	2	4
								2	2	1	2	1

2.	4	2	5	2	3		6.		2	1		2
	2	3	4	4	5			5	7	2	1	4
	1	1	3	2	3			1	2	2	3	3
	3	4	5	3	6			5	2	3	5	5
	6	5	2	7	1			1	3	6	3	2
								4	3	4	7	3

3.	1	2			3		7.			7	3	6
	5	4	7	2	1			4	3	1	1	2
	3	1	1	4	5			5	4	3	4	1
	2	6	2	3	5			1	2	3	3	4
	4	2	4	5	2			7	2	4	6	3
	4	1	4	5	3			2	6	3	1	3

4.	8		1	3	4		8.					3
	1	2	7	5	2			9	8		6	1
	3	5	3	4	7			2	1	7	4	3
	4	3	1	3	1			2	2	6	2	4
	2	7	6	3	2			4	5	2	1	2
								2	3	2	3	1

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
9.			4		5
	7	1	5	3	4
	1	3	1	2	2
	5	5	3	4	3
	3	2	4	6	2
	1	8	2	4	3

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
10.				4	
	7	2		3	7
	2	6	7	4	2
	3	1	1	2	1
	5	4	4	1	6
	2	5	6	3	3

Teach:

$2+9=11$	$11-9=2$	$3+9=12$	$12-9=3$
$3+8=11$	$11-2=9$	$4+8=12$	$12-3=9$
$4+7=11$	$11-8=3$	$5+7=12$	$12-8=4$
$5+6=11$	$11-3=8$	$6+6=12$	$12-4=8$
	$11-4=7$		$12-7=5$
	$11-7=4$		$12-5=7$
	$11-5=6$		$12-6=6$
	$11-6=5$		

Oral drill on number relations.

1. Give at sight:

2	6	12	3	11	4	12	5	12
<u>9</u>	<u>6</u>	<u>-5</u>	<u>8</u>	<u>-7</u>	<u>8</u>	<u>-6</u>	<u>6</u>	<u>-3</u>

2. What are the following sums?

$2+5+5$	$3+6+2$	$2+2+4+4$
$3+4+3+8$	$5+3+3+7$	$2+7+1+5+3$

3. Add:

2	3						5	4
6	6	6	5	7	7	4	2	3
5	3	4	4	5	4	3	3	3
3	5	4	4	2	6	3	2	3
<u>4</u>	<u>2</u>	<u>4</u>	<u>3</u>	<u>4</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>2</u>

4. Subtract :

$$\begin{array}{r} 12 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 11 \\ -7 \\ \hline \end{array} \quad \begin{array}{r} 15 \\ -3 \\ \hline \end{array} \quad \begin{array}{r} 17 \\ -2 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 11 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -8 \\ \hline \end{array}$$

5. Add and subtract :

$$\begin{aligned} 3+5+4+5-2-4+7= \\ 2+7+3+4-5+7-5= \\ 5+2+4+8-5+3-4= \\ 7+1+4+6-5+6-7= \\ 4+4+4-3+1+5-4+5= \end{aligned}$$

6. Mary picked 8 apples from one tree and 4 from another. How many apples did she pick altogether?

7. After giving away 5 marbles, a boy had 7 left. How many marbles had he at first?

8. Kate has saved 6 cents to buy a pencil box. She needs 5 cents more. What will the box cost her?

9. John spent 8 cents and had 3 cents left. How many cents had he at first?

10. A farmer has 17 sheep. He sold 5 of them to one man and then sold 3 to another man. How many sheep has he left?

Teach :

$4+9=13$	$13-9=4$	$5+9=14$	$14-9=5$
$5+8=13$	$13-4=9$	$6+8=14$	$14-5=9$
$6+7=13$	$13-8=5$	$7+7=14$	$14-6=8$
	$13-5=8$		$14-8=6$
	$13-6=7$		$14-7=7$
	$13-7=6$		

Oral drill on number relations.

1. Give at sight :

4	5	5	6	3	6	2	7	5	3
<u>9</u>	<u>9</u>	<u>7</u>	<u>6</u>	<u>8</u>	<u>7</u>	<u>9</u>	<u>7</u>	<u>8</u>	<u>9</u>

2. Subtract :

13	14	12	11	13	14	12	14	13	14
<u>-8</u>	<u>-5</u>	<u>-3</u>	<u>-7</u>	<u>-5</u>	<u>-8</u>	<u>-7</u>	<u>-9</u>	<u>-6</u>	<u>-7</u>

3. Add :

0	5	3	0	1	3	2	1
4	6	7	7	6	5	6	4
5	4	2	5	5	8	0	0
6	2	2	4	3	0	9	7
<u>3</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>4</u>	<u>4</u>	<u>3</u>	<u>7</u>

4. Add and subtract :

$$3+5+6-2+7=$$

$$4+8+7-5+3-6=$$

$$5+9+3-4+6-2=$$

$$7+7-3+8-6+5=$$

$$6+7+5-7+4+3=$$

5. Robert had 14 pigeons. He sold 9 of them. How many pigeons did he have left?

6. Mary had 12 eggs. She sold 6 of them. How many eggs did she have left?

7. Charles is 7 years old, and Tom is 6 years older than Charles. How old is Tom?

8. Doris had 18 cents. She spent 4 cents for some fruit and 5 cents for a book. How many cents did she have left?

9. Harry and Eric are boy scouts. On Tuesday they walked 5 miles, on Wednesday 4 miles, on Thursday 4 miles, and on Friday 6 miles. How far did they walk altogether?

10. Tom has saved 6 cents. Helen has saved 8 cents more than Tom. How many cents have both saved?

Teach:

$6+9=15$	$7+9=16$	$8+9=17$	$9+9=18$
$7+8=15$	$8+8=16$	$17-8=9$	$18-9=9$
$15-9=6$	$16-9=7$	$17-9=8$	
$15-6=9$	$16-7=9$		
$15-8=7$	$16-8=8$		
$15-7=8$			

Oral drill on number relations.

1. Give at sight:

6	8	7	7	9	5	8	7	4	8
9	8	8	9	9	9	6	6	9	9

2. Subtract:

15	14	16	17	18	13	16	15	17	15
-9	-8	-7	-9	-9	-5	-9	-7	-8	-6

3. Add at sight:

5	3	5	4	2	3	5	3	3	8
3	0	0	2	0	1	8	7	9	2
6	9	9	8	9	9	2	5	6	3
3	8	5	6	9	7	4	3	2	4

4. Add and subtract :

$$3+9-5+8-2+6=$$

$$4+9-7+9+2-8=$$

$$8+7+2-9+5+4-8=$$

$$5+7+6-9+7+3-4=$$

$$2+9+7-5-7+9+3=$$

5. Mary bought 1 dozen oranges. She gave away 3 and then bought 6 more. How many oranges has she now?

6. Tom spent 9 cents for candy and 8 cents for nuts. How many cents did he spend for both?

7. Kate sold chickens for her mother. The first day she sold 5 chickens, the second day 4 chickens, the third day 6 chickens, and the fourth day 5 chickens. How many chickens did she sell altogether?

8. Jane has a piece of silk 17 inches long. She cuts off 8 inches from it. How much silk is left?

9. John has 16 marbles, and Harry has 9. How many more marbles has John than Harry?

10. Jean is 8 years old. In how many years will she be 17 years old?

TESTS IN ADDITION UP TO 20

See how many columns the pupils can add in 10 *minutes*, in 5 *minutes*. Check the work by adding both up and down.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	5	2	5	5	2
	3	4	3	2	6
	4	5	4	3	4
	2	6	1	9	5
	3	2	3	2	2

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
2.	5		1	3	4
	3	4	3	6	1
	4	4	2	2	3
	2	8	7	5	1
	5	3	6	2	7

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	3	2	5	2	2
	2	3	3	3	1
	6	6	3	7	5
	6	7	8	4	7
				4	4

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
8.				5	
	6	3	1	1	2
	1	8	7	2	7
	4	1	8	3	5
	5	3	2	5	3
	3	4	1	1	1

4.	2	2	3	2	5
	4	2	2	4	3
	3	6	3	3	1
	2	5	6	2	7
	4	4	5	7	2

9.					3
	3	2	3	1	1
	6	3	2	6	2
	4	3	2	2	3
	2	1	4	5	5
	3	5	3	1	4

5.		2	6		4
	1	3	3	3	4
	3	2	2	5	3
	5	6	5	3	2
	7	1	2	4	4

10.	8	2	9	7	6
	3	5	2	2	1
	2	1	4	5	4
	3	8	2	1	3

6.		5		7	5
	6	2	3	4	2
	2	2	2	2	1
	3	5	8	3	3
	7	4	3	1	6

11.				9	
	9	7	6	2	2
	3	5	3	1	4
	3	2	1	3	2
	2	1	4	2	7

7.	2	5	4	4	
	3	1	3	1	3
	5	4	6	6	2
	7	3	5	2	6
	2	2	1	3	6

12.	9	3	6	4	5
	2	1	2	2	3
	2	3	3	1	4
	3	9	2	6	2

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
13.	2		4	1		14.		7		2	
	3	3	2	5	3		1	3	6	3	
	8	3	1	9	5		3	2	3	1	9
	3	8	7	2	4		2	2	4	3	2
	2	3	5	1	7		9	1	2	6	4
	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>		<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
15.		9		8	
	3	2	3	3	8
	5	3	5	2	2
	1	2	1	3	4
	9	2	9	1	2
	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>

ADDITION AND SUBTRACTION

Introductory.

Add $30 + 42 + 54$

$$\begin{array}{r} 30 \\ 42 \\ 54 \\ \hline 126 \end{array}$$

Write down the numbers under each other, placing the units under units and the tens under tens. Add the units. Add the tens.

Subtract $75 - 54$.

$$\begin{array}{r} 75 \\ 54 \\ \hline 21 \end{array}$$

Write the numbers under each other, placing the units under units and the tens under tens. Take the units from units and the tens from tens.

EXERCISE

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	35	68	25	26	39
	<u>43</u>	<u>71</u>	<u>44</u>	<u>82</u>	<u>40</u>
2.	22	35	54	45	64
	<u>67</u>	<u>70</u>	<u>32</u>	<u>24</u>	<u>30</u>

3.	22	35	24	25	38
	30	12	30	60	70
	<u>46</u>	<u>60</u>	<u>73</u>	<u>24</u>	<u>21</u>
4.	12	40	51	60	75
	23	15	13	23	10
	<u>54</u>	<u>64</u>	<u>24</u>	<u>15</u>	<u>22</u>

Subtract :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	97	87	79	67	58
	<u>82</u>	<u>53</u>	<u>36</u>	<u>35</u>	<u>22</u>
6.	53	87	77	85	99
	<u>41</u>	<u>30</u>	<u>43</u>	<u>34</u>	<u>65</u>
7.	99	65	40	79	83
	<u>36</u>	<u>32</u>	<u>20</u>	<u>23</u>	<u>71</u>

Add :

	<i>a</i>	<i>b</i>	<i>c</i>
8.	$32+40+56$	$42+30+65$	$83+20+16$
9.	$17+20+42$	$89+20+30$	$25+34+40$
10.	$29+60+20$	$34+15+40$	$63+45+60$

Addition with Carrying.

Introductory.

Add $38+46+15$.

38	Write the numbers under each other. Add the units.
46	5+6+8 units are 19 units, which is 1 ten and 9 units. Write
15	the units 9 under the units and carry the 1 ten to the
99	next, or tens column. Adding the tens, 1 and 1 and 4 and
	3 are 9.

To check the result, after adding the columns upward, add the columns downward.

EXERCISE

Add and check the results :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	53	32	45	76	32
	36	18	73	29	59
	<u>78</u>	<u>29</u>	<u>18</u>	<u>37</u>	<u>86</u>
2.	35	49	72	25	27
	83	26	28	18	63
	<u>29</u>	<u>23</u>	<u>36</u>	<u>44</u>	<u>49</u>
3.	27	25	37	26	39
	35	49	28	38	42
	<u>84</u>	<u>56</u>	<u>93</u>	<u>75</u>	<u>75</u>
4.	27	25	46	17	36
	85	72	29	38	27
	<u>34</u>	<u>29</u>	<u>43</u>	<u>95</u>	<u>55</u>
5.	30	45	25	70	25
	29	60	38	29	30
	<u>87</u>	<u>87</u>	<u>94</u>	<u>85</u>	<u>98</u>

6. In Grade 2, there are 19 boys and 28 girls. How many pupils are in the class?

7. John spent 45 cents for a book, 30 cents for a work box, and 39 cents for a drawing outfit. How much did he spend altogether?

8. Kate weighs 89 lbs. Mary weighs 78 lbs. How much do both weigh?

9. Arthur on his holidays travelled 39 miles by train and 47 miles by motor car. How far did he go altogether?

10. William earned 78 cents in May, 35 cents in June, and 82 cents in July. How much did he earn during the three months?

Subtraction with Borrowing.

Introductory.

1. Find the difference between 92 and 75.

$$\begin{array}{r} 92 \\ -75 \\ \hline 17 \end{array}$$
 Write the smaller number under the larger. Begin at the units column. 5 cannot be taken from 2. Take 1 ten from 9 tens leaving 8 tens. Add this 1 ten or 10 units to the 2 units, making 12 units. 5 from 12 = 7 and 7 from 8 = 1.

Check. Add 17 to 75. Sum is 92.

2. Find the difference between 70 and 28.

$$\begin{array}{r} 70 \\ -28 \\ \hline 42 \end{array}$$
 Check by adding 42 and 28. Sum is 70.

EXERCISE

Subtract and check the results :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	$\begin{array}{r} 32 \\ 15 \\ \hline \end{array}$	$\begin{array}{r} 83 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ 56 \\ \hline \end{array}$	$\begin{array}{r} 83 \\ 28 \\ \hline \end{array}$	$\begin{array}{r} 74 \\ 45 \\ \hline \end{array}$
2.	$\begin{array}{r} 60 \\ 37 \\ \hline \end{array}$	$\begin{array}{r} 92 \\ 38 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ 28 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ 34 \\ \hline \end{array}$	$\begin{array}{r} 62 \\ 37 \\ \hline \end{array}$
3.	$\begin{array}{r} 62 \\ 46 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ 48 \\ \hline \end{array}$	$\begin{array}{r} 85 \\ 36 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ 29 \\ \hline \end{array}$
4.	$\begin{array}{r} 66 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 82 \\ 36 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ 48 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ 25 \\ \hline \end{array}$	$\begin{array}{r} 75 \\ 48 \\ \hline \end{array}$

Subtract and check the results :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	84	63	66	71	70
	35	38	27	19	27

6. Mr. Brown is 43 years old. His son is 29 years younger. How old is his son?

7. A farmer had 82 tons of hay. He sold 43 tons. How many tons had he left?

8. Rose had 87 cents. She spent 28 cents. How many cents has she now?

9. Mary bought a book costing 58 cents. She gave the storekeeper 75 cents. How much change did she receive?

10. A boy earned 72 dollars. He bought a pony for 47 dollars. How much money did he have left?

TESTS IN ADDITION AND SUBTRACTION

Find how many of the following examples the pupils can work in 10 *minutes*, and in 5 *minutes* :

Check all the results :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	28	17	36	25	34
	30	30	27	43	50
	29	25	80	30	25
	12	14	24	79	34
2.	43	26	38	62	29
	26	15	42	17	30
	15	40	15	30	46
	30	23	80	18	23

3.	28	39	52	84	27
	14	17	38	30	40
	80	40	20	26	19
	25	22	16	18	24

4.	82	75	83	66	58
	<u>-39</u>	<u>-49</u>	<u>-24</u>	<u>-27</u>	<u>-39</u>

5.	40	63	74	34	71
	<u>-15</u>	<u>-48</u>	<u>-33</u>	<u>-15</u>	<u>-34</u>

6.	80	74	63	57	42
	<u>-29</u>	<u>-38</u>	<u>-39</u>	<u>-28</u>	<u>-29</u>

7.	76	34	46	62	51
	<u>-28</u>	<u>-19</u>	<u>-23</u>	<u>-47</u>	<u>-34</u>

ADDITION OF NUMBERS, THE SUM OF WHICH EXCEEDS 20

Addition by Endings.

Introductory.

Compare	5	25	35	45
	1	4	4	4
	9	29	39	49
	2	22	32	42
	4	4	4	4
	<u>6</u>	<u>26</u>	<u>36</u>	<u>46</u>

Addition of number above 20 should be based on the tables of endings.

TABLES OF 10's:

1	1	1	1	1	1	1	1	1
$\frac{10}{11}$	$\frac{20}{21}$	$\frac{30}{31}$	$\frac{40}{41}$	$\frac{50}{51}$	$\frac{60}{61}$	$\frac{70}{71}$	$\frac{80}{81}$	$\frac{90}{91}$

2	2	2	2	2	2	2	2	2
$\frac{10}{12}$	$\frac{20}{22}$	$\frac{30}{32}$	$\frac{40}{42}$	$\frac{50}{52}$	$\frac{60}{62}$	$\frac{70}{72}$	$\frac{80}{82}$	$\frac{90}{92}$

3	3	3	3	3	3	3	3	3
$\frac{10}{13}$	$\frac{20}{23}$	$\frac{30}{33}$	$\frac{40}{43}$	$\frac{50}{53}$	$\frac{60}{63}$	$\frac{70}{73}$	$\frac{80}{83}$	$\frac{90}{93}$

4	4	4	4	4	4	4	4	4
$\frac{10}{14}$	$\frac{20}{24}$	$\frac{30}{34}$	$\frac{40}{44}$	$\frac{50}{54}$	$\frac{60}{64}$	$\frac{70}{74}$	$\frac{80}{84}$	$\frac{90}{94}$

5	5	5	5	5	5	5	5	5
$\frac{10}{15}$	$\frac{20}{25}$	$\frac{30}{35}$	$\frac{40}{45}$	$\frac{50}{55}$	$\frac{60}{65}$	$\frac{70}{75}$	$\frac{80}{85}$	$\frac{90}{95}$

6	6	6	6	6	6	6	6	6
$\frac{10}{16}$	$\frac{20}{26}$	$\frac{30}{36}$	$\frac{40}{46}$	$\frac{50}{56}$	$\frac{60}{66}$	$\frac{70}{76}$	$\frac{80}{86}$	$\frac{90}{96}$

7	7	7	7	7	7	7	7	7
$\frac{10}{17}$	$\frac{20}{27}$	$\frac{30}{37}$	$\frac{40}{47}$	$\frac{50}{57}$	$\frac{60}{67}$	$\frac{70}{77}$	$\frac{80}{87}$	$\frac{90}{97}$

8	8	8	8	8	8	8	8	8
$\frac{10}{18}$	$\frac{20}{28}$	$\frac{30}{38}$	$\frac{40}{48}$	$\frac{50}{58}$	$\frac{60}{68}$	$\frac{70}{78}$	$\frac{80}{88}$	$\frac{90}{98}$

9	9	9	9	9	9	9	9	9
$\frac{10}{19}$	$\frac{20}{29}$	$\frac{30}{39}$	$\frac{40}{49}$	$\frac{50}{59}$	$\frac{60}{69}$	$\frac{70}{79}$	$\frac{80}{89}$	$\frac{90}{99}$

TABLES OF 1's:

1	1	1	1	1	1	1	1	1	1
$\frac{1}{2}$	$\frac{11}{12}$	$\frac{21}{22}$	$\frac{31}{32}$	$\frac{41}{42}$	$\frac{51}{52}$	$\frac{61}{62}$	$\frac{71}{72}$	$\frac{81}{82}$	$\frac{91}{92}$
2	2	2	2	2	2	2	2	2	2
$\frac{1}{3}$	$\frac{11}{13}$	$\frac{21}{23}$	$\frac{31}{33}$	$\frac{41}{43}$	$\frac{51}{53}$	$\frac{61}{63}$	$\frac{71}{73}$	$\frac{81}{83}$	$\frac{91}{93}$
3	3	3	3	3	3	3	3	3	3
$\frac{1}{4}$	$\frac{11}{14}$	$\frac{21}{24}$	$\frac{31}{34}$	$\frac{41}{44}$	$\frac{51}{54}$	$\frac{61}{64}$	$\frac{71}{74}$	$\frac{81}{84}$	$\frac{91}{94}$
4	4	4	4	4	4	4	4	4	4
$\frac{1}{5}$	$\frac{11}{15}$	$\frac{21}{25}$	$\frac{31}{35}$	$\frac{41}{45}$	$\frac{51}{55}$	$\frac{61}{65}$	$\frac{71}{75}$	$\frac{81}{85}$	$\frac{91}{95}$
5	5	5	5	5	5	5	5	5	5
$\frac{1}{6}$	$\frac{11}{16}$	$\frac{21}{26}$	$\frac{31}{36}$	$\frac{41}{46}$	$\frac{51}{56}$	$\frac{61}{66}$	$\frac{71}{76}$	$\frac{81}{86}$	$\frac{91}{96}$
6	6	6	6	6	6	6	6	6	6
$\frac{1}{7}$	$\frac{11}{17}$	$\frac{21}{27}$	$\frac{31}{37}$	$\frac{41}{47}$	$\frac{51}{57}$	$\frac{61}{67}$	$\frac{71}{77}$	$\frac{81}{87}$	$\frac{91}{97}$
7	7	7	7	7	7	7	7	7	7
$\frac{1}{8}$	$\frac{11}{18}$	$\frac{21}{28}$	$\frac{31}{38}$	$\frac{41}{48}$	$\frac{51}{58}$	$\frac{61}{68}$	$\frac{71}{78}$	$\frac{81}{88}$	$\frac{91}{98}$
8	8	8	8	8	8	8	8	8	8
$\frac{1}{9}$	$\frac{11}{19}$	$\frac{21}{29}$	$\frac{31}{39}$	$\frac{41}{49}$	$\frac{51}{59}$	$\frac{61}{69}$	$\frac{71}{79}$	$\frac{81}{89}$	$\frac{91}{99}$
9	9	9	9	9	9	9	9	9	9
$\frac{1}{10}$	$\frac{11}{20}$	$\frac{21}{30}$	$\frac{31}{40}$	$\frac{41}{50}$	$\frac{51}{60}$	$\frac{61}{70}$	$\frac{71}{80}$	$\frac{81}{90}$	$\frac{91}{100}$

TABLES OF 2's.

1	1	1	1	1	1	1	1	1	1
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
3	13	23	33	43	53	63	73	83	93

2	2	2	2	2	2	2	2	2	2
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
4	14	24	34	44	54	64	74	84	94

3	3	3	3	3	3	3	3	3	3
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
5	15	25	35	45	55	65	75	85	95

4	4	4	4	4	4	4	4	4	4
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
6	16	26	36	46	56	66	76	86	96

5	5	5	5	5	5	5	5	5	5
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
7	17	27	37	47	57	67	77	87	97

6	6	6	6	6	6	6	6	6	6
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
8	18	28	38	48	58	68	78	88	98

7	7	7	7	7	7	7	7	7	7
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
9	19	29	39	49	59	69	79	89	99

8	8	8	8	8	8	8	8	8	8
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
10	20	30	40	50	60	70	80	90	100

9	9	9	9	9	9	9	9	9	9
<u>2</u>	<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>
11	21	31	41	51	61	71	81	91	101

TABLES OF 3's:

1	1	1	1	1	1	1	1	1	1
$\frac{3}{4}$	$\frac{13}{14}$	$\frac{23}{24}$	$\frac{33}{34}$	$\frac{43}{44}$	$\frac{53}{54}$	$\frac{63}{64}$	$\frac{73}{74}$	$\frac{83}{84}$	$\frac{93}{94}$

2	2	2	2	2	2	2	2	2	2
$\frac{3}{5}$	$\frac{13}{15}$	$\frac{23}{25}$	$\frac{33}{35}$	$\frac{43}{45}$	$\frac{53}{55}$	$\frac{63}{65}$	$\frac{73}{75}$	$\frac{83}{85}$	$\frac{93}{95}$

3	3	3	3	3	3	3	3	3	3
$\frac{3}{6}$	$\frac{13}{16}$	$\frac{23}{26}$	$\frac{33}{36}$	$\frac{43}{46}$	$\frac{53}{56}$	$\frac{63}{66}$	$\frac{73}{76}$	$\frac{83}{86}$	$\frac{93}{96}$

4	4	4	4	4	4	4	4	4	4
$\frac{3}{7}$	$\frac{13}{17}$	$\frac{23}{27}$	$\frac{33}{37}$	$\frac{43}{47}$	$\frac{53}{57}$	$\frac{63}{67}$	$\frac{73}{77}$	$\frac{83}{87}$	$\frac{93}{97}$

5	5	5	5	5	5	5	5	5	5
$\frac{3}{8}$	$\frac{13}{18}$	$\frac{23}{28}$	$\frac{33}{38}$	$\frac{43}{48}$	$\frac{53}{58}$	$\frac{63}{68}$	$\frac{73}{78}$	$\frac{83}{88}$	$\frac{93}{98}$

6	6	6	6	6	6	6	6	6	6
$\frac{3}{9}$	$\frac{13}{19}$	$\frac{23}{29}$	$\frac{33}{39}$	$\frac{43}{49}$	$\frac{53}{59}$	$\frac{63}{69}$	$\frac{73}{79}$	$\frac{83}{89}$	$\frac{93}{99}$

7	7	7	7	7	7	7	7	7	7
$\frac{3}{10}$	$\frac{13}{20}$	$\frac{23}{30}$	$\frac{33}{40}$	$\frac{43}{50}$	$\frac{53}{60}$	$\frac{63}{70}$	$\frac{73}{80}$	$\frac{83}{90}$	$\frac{93}{100}$

8	8	8	8	8	8	8	8	8	8
$\frac{3}{11}$	$\frac{13}{21}$	$\frac{23}{31}$	$\frac{33}{41}$	$\frac{43}{51}$	$\frac{53}{61}$	$\frac{63}{71}$	$\frac{73}{81}$	$\frac{83}{91}$	$\frac{93}{101}$

9	9	9	9	9	9	9	9	9	9
$\frac{3}{12}$	$\frac{13}{22}$	$\frac{23}{32}$	$\frac{33}{42}$	$\frac{43}{52}$	$\frac{53}{62}$	$\frac{63}{72}$	$\frac{73}{82}$	$\frac{83}{92}$	$\frac{93}{102}$

TABLES OF 4's:

1	1	1	1	1	1	1	1	1	1
$\frac{4}{5}$	$\frac{14}{15}$	$\frac{24}{25}$	$\frac{34}{35}$	$\frac{44}{45}$	$\frac{54}{55}$	$\frac{64}{65}$	$\frac{74}{75}$	$\frac{84}{85}$	$\frac{94}{95}$
2	2	2	2	2	2	2	2	2	2
$\frac{4}{6}$	$\frac{14}{16}$	$\frac{24}{26}$	$\frac{34}{36}$	$\frac{44}{46}$	$\frac{54}{56}$	$\frac{64}{66}$	$\frac{74}{76}$	$\frac{84}{86}$	$\frac{94}{96}$
3	3	3	3	3	3	3	3	3	3
$\frac{4}{7}$	$\frac{14}{17}$	$\frac{24}{27}$	$\frac{34}{37}$	$\frac{44}{47}$	$\frac{54}{57}$	$\frac{64}{67}$	$\frac{74}{77}$	$\frac{84}{87}$	$\frac{94}{97}$
4	4	4	4	4	4	4	4	4	4
$\frac{4}{8}$	$\frac{14}{18}$	$\frac{24}{28}$	$\frac{34}{38}$	$\frac{44}{48}$	$\frac{54}{58}$	$\frac{64}{68}$	$\frac{74}{78}$	$\frac{84}{88}$	$\frac{94}{98}$
5	5	5	5	5	5	5	5	5	5
$\frac{4}{9}$	$\frac{14}{19}$	$\frac{24}{29}$	$\frac{34}{39}$	$\frac{44}{49}$	$\frac{54}{59}$	$\frac{64}{69}$	$\frac{74}{79}$	$\frac{84}{89}$	$\frac{94}{99}$
6	6	6	6	6	6	6	6	6	6
$\frac{4}{10}$	$\frac{14}{20}$	$\frac{24}{30}$	$\frac{34}{40}$	$\frac{44}{50}$	$\frac{54}{60}$	$\frac{64}{70}$	$\frac{74}{80}$	$\frac{84}{90}$	$\frac{94}{100}$
7	7	7	7	7	7	7	7	7	7
$\frac{4}{11}$	$\frac{14}{21}$	$\frac{24}{31}$	$\frac{34}{41}$	$\frac{44}{51}$	$\frac{54}{61}$	$\frac{64}{71}$	$\frac{74}{81}$	$\frac{84}{91}$	$\frac{94}{101}$
8	8	8	8	8	8	8	8	8	8
$\frac{4}{12}$	$\frac{14}{22}$	$\frac{24}{32}$	$\frac{34}{42}$	$\frac{44}{52}$	$\frac{54}{62}$	$\frac{64}{72}$	$\frac{74}{82}$	$\frac{84}{92}$	$\frac{94}{102}$
9	9	9	9	9	9	9	9	9	9
$\frac{4}{13}$	$\frac{14}{23}$	$\frac{24}{33}$	$\frac{34}{43}$	$\frac{44}{53}$	$\frac{54}{63}$	$\frac{64}{73}$	$\frac{74}{83}$	$\frac{84}{93}$	$\frac{94}{103}$

TABLES OF 5's:

1	1	1	1	1	1	1	1	1	1
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
6	16	26	36	46	56	66	76	86	96

2	2	2	2	2	2	2	2	2	2
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
7	17	27	37	47	57	67	77	87	97

3	3	3	3	3	3	3	3	3	3
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
8	18	28	38	48	58	68	78	88	98

4	4	4	4	4	4	4	4	4	4
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
9	19	29	39	49	59	69	79	89	99

5	5	5	5	5	5	5	5	5	5
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
10	20	30	40	50	60	70	80	90	100

6	6	6	6	6	6	6	6	6	6
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
11	21	31	41	51	61	71	81	91	101

7	7	7	7	7	7	7	7	7	7
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
12	22	32	42	52	62	72	82	92	102

8	8	8	8	8	8	8	8	8	8
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
13	23	33	43	53	63	73	83	93	103

9	9	9	9	9	9	9	9	9	9
<u>5</u>	<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>
14	24	34	44	54	64	74	84	94	104

TABLES OF 6's:

1	1	1	1	1	1	1	1	1	1
6	16	26	36	46	56	66	76	86	96
<u>7</u>	<u>17</u>	<u>27</u>	<u>37</u>	<u>47</u>	<u>57</u>	<u>67</u>	<u>77</u>	<u>87</u>	<u>97</u>
2	2	2	2	2	2	2	2	2	2
6	16	26	36	46	56	66	76	86	96
<u>8</u>	<u>18</u>	<u>28</u>	<u>38</u>	<u>48</u>	<u>58</u>	<u>68</u>	<u>78</u>	<u>88</u>	<u>98</u>
3	3	3	3	3	3	3	3	3	3
6	16	26	36	46	56	66	76	86	96
<u>9</u>	<u>19</u>	<u>29</u>	<u>39</u>	<u>49</u>	<u>59</u>	<u>69</u>	<u>79</u>	<u>89</u>	<u>99</u>
4	4	4	4	4	4	4	4	4	4
6	16	26	36	46	56	66	76	86	96
<u>10</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>50</u>	<u>60</u>	<u>70</u>	<u>80</u>	<u>90</u>	<u>100</u>
5	5	5	5	5	5	5	5	5	5
6	16	26	36	46	56	66	76	86	96
<u>11</u>	<u>21</u>	<u>31</u>	<u>41</u>	<u>51</u>	<u>61</u>	<u>71</u>	<u>81</u>	<u>91</u>	<u>101</u>
6	6	6	6	6	6	6	6	6	6
6	16	26	36	46	56	66	76	86	96
<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>	<u>102</u>
7	7	7	7	7	7	7	7	7	7
6	16	26	36	46	56	66	76	86	96
<u>13</u>	<u>23</u>	<u>33</u>	<u>43</u>	<u>53</u>	<u>63</u>	<u>73</u>	<u>83</u>	<u>93</u>	<u>103</u>
8	8	8	8	8	8	8	8	8	8
6	16	26	36	46	56	66	76	86	96
<u>14</u>	<u>24</u>	<u>34</u>	<u>44</u>	<u>54</u>	<u>64</u>	<u>74</u>	<u>84</u>	<u>94</u>	<u>104</u>
9	9	9	9	9	9	9	9	9	9
6	16	26	36	46	56	66	76	86	96
<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>	<u>105</u>

TABLES OF 7's:

1	1	1	1	1	1	1	1	1	1
$\frac{7}{8}$	$\frac{17}{18}$	$\frac{27}{28}$	$\frac{37}{38}$	$\frac{47}{48}$	$\frac{57}{58}$	$\frac{67}{68}$	$\frac{77}{78}$	$\frac{87}{88}$	$\frac{97}{98}$
2	2	2	2	2	2	2	2	2	2
$\frac{7}{9}$	$\frac{17}{19}$	$\frac{27}{29}$	$\frac{37}{39}$	$\frac{47}{49}$	$\frac{57}{59}$	$\frac{67}{69}$	$\frac{77}{79}$	$\frac{87}{89}$	$\frac{97}{99}$
3	3	3	3	3	3	3	3	3	3
$\frac{7}{10}$	$\frac{17}{20}$	$\frac{27}{30}$	$\frac{37}{40}$	$\frac{47}{50}$	$\frac{57}{60}$	$\frac{67}{70}$	$\frac{77}{80}$	$\frac{87}{90}$	$\frac{97}{100}$
4	4	4	4	4	4	4	4	4	4
$\frac{7}{11}$	$\frac{17}{21}$	$\frac{27}{31}$	$\frac{37}{41}$	$\frac{47}{51}$	$\frac{57}{61}$	$\frac{67}{71}$	$\frac{77}{81}$	$\frac{87}{91}$	$\frac{97}{101}$
5	5	5	5	5	5	5	5	5	5
$\frac{7}{12}$	$\frac{17}{22}$	$\frac{27}{32}$	$\frac{37}{42}$	$\frac{47}{52}$	$\frac{57}{62}$	$\frac{67}{72}$	$\frac{77}{82}$	$\frac{87}{92}$	$\frac{97}{102}$
6	6	6	6	6	6	6	6	6	6
$\frac{7}{13}$	$\frac{17}{23}$	$\frac{27}{33}$	$\frac{37}{43}$	$\frac{47}{53}$	$\frac{57}{63}$	$\frac{67}{73}$	$\frac{77}{83}$	$\frac{87}{93}$	$\frac{97}{103}$
7	7	7	7	7	7	7	7	7	7
$\frac{7}{14}$	$\frac{17}{24}$	$\frac{27}{34}$	$\frac{37}{44}$	$\frac{47}{54}$	$\frac{57}{64}$	$\frac{67}{74}$	$\frac{77}{84}$	$\frac{87}{94}$	$\frac{97}{104}$
8	8	8	8	8	8	8	8	8	8
$\frac{7}{15}$	$\frac{17}{25}$	$\frac{27}{35}$	$\frac{37}{45}$	$\frac{47}{55}$	$\frac{57}{65}$	$\frac{67}{75}$	$\frac{77}{85}$	$\frac{87}{95}$	$\frac{97}{105}$
9	9	9	9	9	9	9	9	9	9
$\frac{7}{16}$	$\frac{17}{26}$	$\frac{27}{36}$	$\frac{37}{46}$	$\frac{47}{56}$	$\frac{57}{66}$	$\frac{67}{76}$	$\frac{77}{86}$	$\frac{87}{96}$	$\frac{97}{106}$

TABLES OF 8's:

1	1	1	1	1	1	1	1	1	1
8	18	28	38	48	58	68	78	88	98
<u>9</u>	<u>19</u>	<u>29</u>	<u>39</u>	<u>49</u>	<u>59</u>	<u>69</u>	<u>79</u>	<u>89</u>	<u>99</u>
2	2	2	2	2	2	2	2	2	2
8	18	28	38	48	58	68	78	88	98
<u>10</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>50</u>	<u>60</u>	<u>70</u>	<u>80</u>	<u>90</u>	<u>100</u>
3	3	3	3	3	3	3	3	3	3
8	18	28	38	48	58	68	78	88	98
<u>11</u>	<u>21</u>	<u>31</u>	<u>41</u>	<u>51</u>	<u>61</u>	<u>71</u>	<u>81</u>	<u>91</u>	<u>101</u>
4	4	4	4	4	4	4	4	4	4
8	18	28	38	48	58	68	78	88	98
<u>12</u>	<u>22</u>	<u>32</u>	<u>42</u>	<u>52</u>	<u>62</u>	<u>72</u>	<u>82</u>	<u>92</u>	<u>102</u>
5	5	5	5	5	5	5	5	5	5
8	18	28	38	48	58	68	78	88	98
<u>13</u>	<u>23</u>	<u>33</u>	<u>43</u>	<u>53</u>	<u>63</u>	<u>73</u>	<u>83</u>	<u>93</u>	<u>103</u>
6	6	6	6	6	6	6	6	6	6
8	18	28	38	48	58	68	78	88	98
<u>14</u>	<u>24</u>	<u>34</u>	<u>44</u>	<u>54</u>	<u>64</u>	<u>74</u>	<u>84</u>	<u>94</u>	<u>104</u>
7	7	7	7	7	7	7	7	7	7
8	18	28	38	48	58	68	78	88	98
<u>15</u>	<u>25</u>	<u>35</u>	<u>45</u>	<u>55</u>	<u>65</u>	<u>75</u>	<u>85</u>	<u>95</u>	<u>105</u>
8	8	8	8	8	8	8	8	8	8
8	18	28	38	48	58	68	78	88	98
<u>16</u>	<u>26</u>	<u>36</u>	<u>46</u>	<u>56</u>	<u>66</u>	<u>76</u>	<u>86</u>	<u>96</u>	<u>106</u>
9	9	9	9	9	9	9	9	9	9
8	18	28	38	48	58	68	78	88	98
<u>17</u>	<u>27</u>	<u>37</u>	<u>47</u>	<u>57</u>	<u>67</u>	<u>77</u>	<u>87</u>	<u>97</u>	<u>107</u>

TABLE OF 9's:

1	1	1	1	1	1	1	1	1	1
$\frac{9}{10}$	$\frac{19}{20}$	$\frac{29}{30}$	$\frac{39}{40}$	$\frac{49}{50}$	$\frac{59}{60}$	$\frac{69}{70}$	$\frac{79}{80}$	$\frac{89}{90}$	$\frac{99}{100}$
2	2	2	2	2	2	2	2	2	2
$\frac{9}{11}$	$\frac{19}{21}$	$\frac{29}{31}$	$\frac{39}{41}$	$\frac{49}{51}$	$\frac{59}{61}$	$\frac{69}{71}$	$\frac{79}{81}$	$\frac{89}{91}$	$\frac{99}{101}$
3	3	3	3	3	3	3	3	3	3
$\frac{9}{12}$	$\frac{19}{22}$	$\frac{29}{32}$	$\frac{39}{42}$	$\frac{49}{52}$	$\frac{59}{62}$	$\frac{69}{72}$	$\frac{79}{82}$	$\frac{89}{92}$	$\frac{99}{102}$
4	4	4	4	4	4	4	4	4	4
$\frac{9}{13}$	$\frac{19}{23}$	$\frac{29}{33}$	$\frac{39}{43}$	$\frac{49}{53}$	$\frac{59}{63}$	$\frac{69}{73}$	$\frac{79}{83}$	$\frac{89}{93}$	$\frac{99}{103}$
5	5	5	5	5	5	5	5	5	5
$\frac{9}{14}$	$\frac{19}{24}$	$\frac{29}{34}$	$\frac{39}{44}$	$\frac{49}{54}$	$\frac{59}{64}$	$\frac{69}{74}$	$\frac{79}{84}$	$\frac{89}{94}$	$\frac{99}{104}$
6	6	6	6	6	6	6	6	6	6
$\frac{9}{15}$	$\frac{19}{25}$	$\frac{29}{35}$	$\frac{39}{45}$	$\frac{49}{55}$	$\frac{59}{65}$	$\frac{69}{75}$	$\frac{79}{85}$	$\frac{89}{95}$	$\frac{99}{105}$
7	7	7	7	7	7	7	7	7	7
$\frac{9}{16}$	$\frac{19}{26}$	$\frac{29}{36}$	$\frac{39}{46}$	$\frac{49}{56}$	$\frac{59}{66}$	$\frac{69}{76}$	$\frac{79}{86}$	$\frac{89}{96}$	$\frac{99}{106}$
8	8	8	8	8	8	8	8	8	8
$\frac{9}{17}$	$\frac{19}{27}$	$\frac{29}{37}$	$\frac{39}{47}$	$\frac{49}{57}$	$\frac{59}{67}$	$\frac{69}{77}$	$\frac{79}{87}$	$\frac{89}{97}$	$\frac{99}{107}$
9	9	9	9	9	9	9	9	9	9
$\frac{9}{18}$	$\frac{19}{28}$	$\frac{29}{38}$	$\frac{39}{48}$	$\frac{49}{58}$	$\frac{59}{68}$	$\frac{69}{78}$	$\frac{79}{88}$	$\frac{89}{98}$	$\frac{99}{108}$

A lesson on the tables should always be followed by the application of the tables in addition columns. The order of the numbers in the addition columns should be carefully chosen, so as to include the number relations taught in the tables along with the combinations of the numbers up to 20.

In presenting the tables of endings to the pupils, emphasize the ending forms. For example :

3	3	3	3	3
5	25	45	15	55
<u>8</u>	<u>28</u>	<u>48</u>	<u>18</u>	<u>58</u> etc.

The teacher should draw attention to the fact that the ending of the units in each case is the same. Give the pupils frequent oral drills on the tables, dictating the numbers in various sequences.

The tables should be applied in both oral and sight addition.

Examples :

Addition based on tables ending in 6 and 7.

				7
			5	3
			7	7
		3	4	1
	7	7	6	5
7	3	6	3	7
2	7	5	7	7
2	3	2	2	3
6	7	7	9	8
<u>6</u>	<u>6</u>	<u>6</u>	<u>5</u>	<u>5</u>

Addition based on tables ending in 3 and 5.

		7	6	2
		5	4	3
	3	3	3	7
	7	1	3	5
6	3	6	4	5
2	1	3	5	3
5	6	5	3	3
3	3	2	1	4
4	3	6	3	3
3	9	8	9	3
<u>5</u>	<u>3</u>	<u>4</u>	<u>7</u>	<u>2</u>

Drill on tables of endings.

The following are suggested as drill exercises based on the tables of endings.

The teacher dictates the following and the pupils give the answers:

1.	12	17	26	35	19	27	16	29	18	33
	<u>7</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>4</u>	<u>5</u>	<u>9</u>	<u>5</u>	<u>9</u>	<u>9</u>
2.	22	35	42	25	18	25	14	47	26	37
	<u>9</u>	<u>8</u>	<u>9</u>	<u>8</u>	<u>6</u>	<u>9</u>	<u>8</u>	<u>6</u>	<u>5</u>	<u>9</u>

Add at sight:

3.	6	5	8	5	4	7	3	5	3	5
	<u>8</u>	<u>7</u>	<u>2</u>	<u>7</u>	<u>6</u>	<u>4</u>	<u>9</u>	<u>9</u>	<u>2</u>	<u>6</u>
	3	6	7	6	9	8	7	4	9	8
	<u>7</u>	<u>3</u>	<u>5</u>	<u>7</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>5</u>	<u>7</u>	<u>7</u>
	<u>5</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>8</u>	<u>6</u>	<u>6</u>	<u>8</u>	<u>5</u>	<u>9</u>

8.	59	26	29	19	28	19	84	37
	82	85	37	25	35	26	36	56
	24	17	15	42	64	17	59	43
	17	62	25	39	17	85	84	62
	55	82	83	82	28	27	92	95
	<u>19</u>	<u>26</u>	<u>45</u>	<u>95</u>	<u>35</u>	<u>39</u>	<u>89</u>	<u>28</u>

9. A man bought 3 turkeys. The first weighed 19 lbs., the second 16 lbs., the third 23 lbs. Find the weight of the 3 turkeys.

10. A farmer has 29 Berkshire pigs, 38 Yorkshire pigs, and 34 Tamworth pigs. How many pigs has he altogether?

11. Kate has 37 Leghorn hens, 28 Plymouth Rocks, and 57 Rhode Island Reds. How many hens has she altogether?

12. Bertha has read 76 pages in one book, 38 pages in another, and 86 pages in a third book. How many pages has she read altogether in the three books?

13. Ethel's mother bought 29 lbs. of potatoes, 38 lbs. of carrots, and 75 lbs. of beets. How many pounds of vegetables did she buy altogether?

14. Alan saved 34 cents in March, 29 cents in April, and 78 cents in May. How much money did he save altogether during the three months?

15. Eric attended school 19 days in September, 18 days in October, 19 days in November, and 16 days in December. How many days did he attend school during the four months?

16. Tom's father gave him 34 marbles, his uncle gave him 27 more, and his cousin gave him 39. He put all of them in one bag. How many marbles did he have in the bag?

TEST IN ADDITION

Add the following. Find how many of these the pupils can add accurately in 10 *minutes*, and in 5 *minutes*. Check the work by adding both up and down.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	33	12	67	43	72
	42	26	34	37	26
	27	43	52	62	63
	57	52	46	26	45
	34	35	21	25	34
	20	26	43	12	21
2.	17	26	43	16	36
	42	43	36	23	48
	33	52	12	42	73
	55	63	67	31	22
	34	22	54	63	55
	41	56	32	25	61
3.	53	30	16	36	24
	25	27	23	42	62
	31	31	71	35	13
	46	53	23	72	29
	73	44	45	21	43
	42	34	31	43	33
4.				12	
	31	56	27	35	35
	25	62	43	41	32
	47	23	31	73	27
	34	31	65	32	41
	27	54	42	64	32
	41	62	33	56	18

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	23	20	17	32	40
	62	36	32	64	16
	34	53	23	25	26
	87	41	55	34	41
	51	25	62	13	39
	<u>22</u>	<u>39</u>	<u>34</u>	<u>45</u>	<u>73</u>
6.	40	71	19	73	28
	25	38	63	26	71
	37	13	72	62	64
	62	42	35	37	36
	59	57	12	13	43
	<u>42</u>	<u>62</u>	<u>34</u>	<u>42</u>	<u>52</u>
7.	20	17	34	35	17
	43	62	62	24	28
	18	21	28	63	43
	52	45	41	42	63
	64	33	56	35	34
	<u>27</u>	<u>55</u>	<u>33</u>	<u>26</u>	<u>70</u>
8.	36	27	24	72	62
	29	56	69	38	75
	15	68	43	47	30
	20	30	15	30	85
	<u>43</u>	<u>42</u>	<u>32</u>	<u>28</u>	<u>44</u>
9.	45	27	83	29	53
	30	80	24	32	27
	27	29	30	10	40
	64	14	15	45	34
	<u>15</u>	<u>35</u>	<u>47</u>	<u>39</u>	<u>58</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
10.	36	37	43	37	43
	42	83	85	82	36
	80	29	30	56	20
	39	10	19	40	83
	<u>15</u>	<u>42</u>	<u>54</u>	<u>59</u>	<u>24</u>

GROUP COUNTING*Counting by 10's:*

Count by 10 to 50, to 60, to 70, to 90, to 100.

What are 2 tens? 5 tens? 8 tens? 7 tens?

How many tens are in 30? 60? 90? 70?

What are 4 tens and 3 more? What are 5 tens and 6 more?

What are 7 tens and 9 more?

How many tens are in 17? 28? 43? 39? 76? 82? 95?

Counting by 5's:

Count by 5's to 25, to 40, to 60, to 35.

What are 3 fives? 6 fives? 8 fives? 10 fives? etc.

How many fives are in 15? 30? 50? 25? 45? etc.

What are 4 fives and 2 more? What are 8 fives and 3 more? What are 10 fives and 1 more? etc.

How many fives are in 24? 32? 46? 54? etc.

Counting by 2's:

Count by 2's to 14, to 16, to 20, to 24

What are 10 twos? 6 twos? 4 twos? etc.

How many twos are in 12? 22? 14? 10? 8? 18? etc.

What are 4 twos and 3 more, 7 twos and 5 more? etc.

How many twos are in 11? 21? 17? 13? 9? etc.

Counting by 4's:

Count by 4's to 16, to 32, to 40, to 48, etc.

What are 5 fours? 7 fours? 3 fours? etc.

How many fours are in 12? 24? 32? etc.

What are 5 fours and 3 more? What are 7 fours and 2 more? etc.

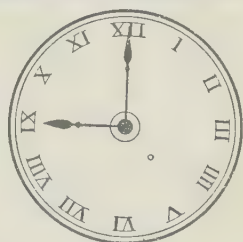
How many fours are in 22? 37? 18? 35? etc.

TELLING TIME

TO THE TEACHER. — The teacher should have a cardboard clock dial with movable hands. This should be used in teaching the time and in testing the pupils in telling time.

Review with the pupils the numerals on the clock dial. Test the class in telling the hour, half hour, and quarter hour.

Show the divisions on the clock for minutes. Each hour space represents 5 minute spaces.



CLOCK

By means of the clock dial, show the pupils the following:

5 minutes past the hour, 10 minutes past the hour.

20 minutes past the hour, 25 minutes past the hour.

5 minutes to the hour, 10 minutes to the hour.

20 minutes to the hour, 25 minutes to the hour

EXERCISE

Move the hands of the clock dial to represent the following time and ask the pupils to tell the time:

1. 20 minutes after 3; 10 minutes after 5; 25 minutes after 8; 5 minutes after 4.

2. 10 minutes to 2; 25 minutes to 6; 5 minutes to 7; 25 minutes to 12.

Show the pupils the *one-minute* spaces.

Test the pupils in pointing out different minute spaces such as :

3. 4 minutes after the hour, 16 minutes after the hour, 22 minutes after the hour, etc.

4. 12 minutes to the hour, 26 minutes to the hour, 22 minutes to the hour, etc

By means of the clock dial show the pupils different time and have them read the time.

Test the individual pupils carefully and frequently. This work should be continued until each one is able to read the time without difficulty.

Move the hands of the clock dial to represent the following time. Ask the pupils to tell the time.

5. 17 minutes after 5; 26 minutes after 8; 19 minutes after 2, etc.

6. 24 minutes to 2; 3 minutes to 4; 14 minutes to 6, etc.

CANADIAN MONEY

The teacher should have the various coins of Canadian money in the class room. The children should become familiar with the different coins and with the one-dollar bill.

Using the actual coins, the teacher should give the pupils exercises in exchanging coins for those of other denominations, making change, etc.

5 one-cent pieces = 1 five-cent piece.

2 five-cent pieces = 1 ten-cent piece

4 quarters = 1 dollar.

2 quarters = 1 fifty-cent piece.

2 fifty-cent pieces = 1 dollar.

Notation for Canadian Money.

Introductory.

1. John has 2 dollars. Write down how much money he has.

$$2 \text{ dollars} = \$2$$

2. Mary has 3 dollars and 25 cents. Write down how much money she has.

$$3 \text{ dollars and } 25 \text{ cents} = \$3.25.$$

EXERCISE

Read the following sums of money :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	\$ 3.75	\$4.	\$ 2.25	\$ 6.35	\$ 8.15
2.	\$ 5.45	\$9.	\$ 7.85	\$ 2.40	\$13.75
3.	\$ 6.72	\$3.83	\$15.24	\$ 7.29	\$ 9.13
4.	\$25.27	\$4.73	\$65.27	\$12.43	\$ 2.26

Write down from dictation :

5.	\$ 3.25	\$ 4.	\$ 5.50	\$ 6.25	\$9.
6.	\$12.50	\$ 7.35	\$24.35	\$13.65	\$4.13
7.	\$ 2.95	\$ 4.27	\$ 6.34	\$22.23	\$7.29
8.	\$10.25	\$17.43	\$24.72	\$13.36	\$8.31

ADDITION UP TO 50

Give at sight :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
1.	37	27	19	47	38	42	25	33	47	29
	<u>9</u>	<u>8</u>	<u>9</u>	<u>6</u>	<u>5</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>8</u>	<u>5</u>
2.	28	45	46	29	32	25	16	7	29	36
	<u>3</u>	<u>7</u>	<u>6</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>8</u>	<u>9</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
3.	29	42	15	26	17	36	29	34	39	35
	<u>3</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>5</u>	<u>8</u>	<u>5</u>	<u>8</u>	<u>7</u>	<u>8</u>

Add at sight :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
4.	9	5	2	5	8
	8	9	9	9	4
	7	6	7	8	6
	6	8	6	4	5
	8	3	9	7	8
	<u>3</u>	<u>8</u>	<u>3</u>	<u>6</u>	<u>3</u>
5.	8	8	7	8	6
	3	9	8	5	9
	9	5	0	7	8
	4	7	9	9	3
	5	6	8	3	9
	<u>3</u>	<u>8</u>	<u>9</u>	<u>8</u>	<u>5</u>

Add from dictation :

6. *a.* $9+5+8+7+3+6=$ \times
b. $8+5+9+7+8+9=$ \times
c. $9+7+8+8+7+5=$ \times
d. $7+6+9+2+8+9=$ \times
e. $6+9+8+5+7+6=$ \times

7. *a.* $9+4+6+5+8+7=$
b. $8+6+5+9+6+5=$
c. $5+7+9+6+7+9=$
d. $8+6+8+9+5+7=$
e. $6+7+9+7+8+6=$

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
8.	38	48	82	39	84
	47	36	29	87	39
	95	52	17	56	45
	36	20	29	29	73
	20	84	84	64	85
	<u>62</u>	<u>39</u>	<u>70</u>	<u>75</u>	<u>96</u>
9.	27	75	52	29	76
	83	83	65	83	83
	90	29	83	77	29
	57	16	29	65	17
	64	34	70	80	28
	<u>38</u>	<u>27</u>	<u>24</u>	<u>29</u>	<u>66</u>
10.	29	89	27	36	83
	38	36	83	22	70
	45	25	95	85	29
	38	43	24	40	48
	84	99	54	39	34
	36	64	63	76	65
	57	27	92	15	13
	<u>20</u>	<u>30</u>	<u>78</u>	<u>47</u>	<u>44</u>

Drill on subtraction.

Subtract and check the answers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1.	78	47	65	84	82	71
	<u>29</u>	<u>29</u>	<u>38</u>	<u>26</u>	<u>38</u>	<u>44</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
2.	62 <u>29</u>	85 <u>56</u>	93 <u>47</u>	82 <u>48</u>	60 <u>29</u>	70 <u>44</u>
3.	478 <u>259</u>	543 <u>216</u>	768 <u>239</u>	363 <u>128</u>	275 <u>138</u>	428 <u>109</u>
4.	571 <u>316</u>	582 <u>415</u>	871 <u>317</u>	674 <u>339</u>	863 <u>247</u>	443 <u>219</u>
5.	342 <u>127</u>	780 <u>526</u>	781 <u>506</u>	650 <u>227</u>	781 <u>209</u>	787 <u>329</u>
6.	283 <u>109</u>	522 <u>117</u>	670 <u>249</u>	445 <u>208</u>	762 <u>307</u>	281 <u>129</u>
7.	983 <u>257</u>	830 <u>417</u>	722 <u>109</u>	637 <u>218</u>	530 <u>218</u>	720 <u>313</u>
8.	624 <u>109</u>	763 <u>406</u>	2653 <u>1338</u>	7262 <u>5129</u>	6472 <u>2108</u>	3690 <u>2267</u>

NOTATION OF HUNDREDS

Introductory.

Read the following numbers : 326, 459, 787, 893, 905.

Study the number 326.

6 represents 6 units.

2 represents 2 tens.

3 represents 3 hundreds.

The third place in writing numbers is the hundreds place.

1 hundred = 10 tens = 100 units.

EXERCISE

State the units, tens, and hundreds in each of the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	387	206	560	368	983
2.	253	750	893	222	456
3.	759	836	263	457	629
4.	826	543	294	836	720
5.	264	703	963	263	765

ACCURACY AND TIME TESTS

Have the pupils work the following exercises. Check the addition and subtraction. Find how many they can work accurately in 10 *minutes*, and in 5 *minutes*.

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	38	56	29	57	72
	49	28	37	63	18
	20	40	56	40	25
	56	29	24	98	83
	83	36	30	35	29
	29	75	48	24	54
	37	39	59	38	67
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
2.	54	37	24	17	45
	63	60	39	29	63
	85	28	50	83	27
	72	54	83	45	19
	29	35	27	62	29
	13	26	43	84	83
	40	72	25	72	27
	29	85	86	89	40
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

3. 48	17	38	47	69
29	28	45	65	72
37	35	60	20	17
20	84	83	33	28
54	36	29	17	35
63	65	19	45	62
84	72	65	86	45
<u>29</u>	<u>29</u>	<u>83</u>	<u>29</u>	<u>83</u>

Arrange the following numbers in vertical columns, and add :

4. *a.* $38+56+22+19+40+72+29$
b. $17+38+33+45+92+46+36$
c. $52+19+70+85+39+45+63$
d. $84+23+75+34+26+50+28$
e. $69+29+35+25+56+40+39$
5. *a.* $36+72+84+49+38+59+30$
b. $44+83+65+17+29+35+60$
c. $85+16+74+34+87+70+26$
d. $93+64+85+46+25+43+80$
e. $75+22+66+47+50+77+19$
6. *a.* $42+59+16+30+57+34+85$
b. $36+85+20+49+33+65+27$
c. $84+50+36+77+45+32+66$
d. $29+35+88+30+75+83+29$
e. $15+69+36+72+83+25+39$

Subtract, and check the results :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
7. 652	745	633	581	982
<u>349</u>	<u>208</u>	<u>217</u>	<u>265</u>	<u>735</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
8.	293	537	645	930	432
	<u>108</u>	<u>218</u>	<u>236</u>	<u>727</u>	<u>213</u>
9.	736	320	435	680	753
	<u>218</u>	<u>108</u>	<u>229</u>	<u>264</u>	<u>249</u>

Add and subtract :

10. *a.* $9+8+5-8+7+9-8+5-9+6-8$
b. $4+9+5+8-9+7-8+9-7+6-3$
c. $6+8+5+9-7+8+5-7+9+5-9$
d. $7+9+7-9+4+7-8+5+7-8-9$
e. $9+8+7-8+5+6-9-8-5+8+7$

CHAPTER III

NOTATION, NUMERATION. THE FOUR SIMPLE RULES

READING AND WRITING NUMBERS FROM 1000 TO 10,000

One thousand is written 1000.

Two thousand is written 2000.

Three thousand is written 3000.

Four thousand is written 4000.

Five thousand is written 5000.

Six thousand is written 6000.

Seven thousand is written 7000.

Eight thousand is written 8000.

Nine thousand is written 9000.

Ten thousand is written 10,000.

One thousand eight hundred and sixty-seven is written 1867. $1867 = 1$ thousand 8 hundreds 6 tens 7 units.

Five thousand two hundred forty-three is written 5243. $5243 = 5$ thousands 2 hundreds 4 tens 3 units.

Note. — The *fourth* place in writing numbers is the *thousands* place.

Read the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	5367	8231	6729	3283	7273
2.	7650	5305	9284	7638	4303
3.	2100	7340	9200	8460	6050
4.	6500	2034	5089	9060	8072
5.	7004	8600	9007	6005	8030

Write from dictation :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
6.	3227	4583	6720	8329	2365
7.	5286	9837	4628	5675	8364
8.	7200	6030	5072	8072	6070
9.	2005	3070	6008	9035	8040
10.	5643	7083	9006	7016	8036

Write down the following numbers, stating the number of thousands, hundreds, tens, and units in each number
Thus :

6328 = 6 thousands, 3 hundreds, 2 tens, 8 units.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
11.	3275	4860	5983	7659	8340
12.	9650	7835	8420	9225	6427
13.	8700	5600	2830	4020	7006
14.	9006	8002	6070	4075	6040
15.	6500	7200	8263	5960	7239

NOTE TO THE TEACHER. — The pupils should be given frequent practice in reading numbers.

Write in figures :

16. Two thousand three hundred sixty-three.
17. Four thousand five hundred seventy.
18. Eight thousand twenty-seven.
19. Nine thousand three hundred six.
20. Six thousand two hundred ninety-six.

Roman Notation up to 25

Write down the Roman numbers for :

10 5 3 1 12 9 7 4 8

In reading the time the pupils have learned :

1	2	3	4	5	6
I	II	III	IV	V	VI
7	8	9	10	11	12
VII	VIII	IX	X	XI	XII

To write 15 the symbols for 10 and 5 are used. Thus,

$$15 = 10 + 5 = \text{XV} \qquad 20 = 10 + 10 = \text{XX}$$

$$19 = 10 + 9 = \text{XIX} \qquad 21 = 20 + 1 = \text{XXI}$$

$$25 = 10 + 10 + 5 = \text{XXV}$$

Teach :

13	14	15	16	17	18	19
XIII	XIV	XV	XVI	XVII	XVIII	XIX
20	21	22	23	24	25	
XX	XXI	XXII	XXIII	XXIV	XXV	

EXERCISE

Read the following numbers aloud :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	XIV	XVII	XXII	XV	XIX
2.	IX	XXIV	XIV	XVIII	XXI
3.	XIII	XX	XI	XXV	XVI
4.	XXIII	XII	X	XIX	XXIV

Write in figures the numbers expressed by the Roman numerals given above.

ADDITION

The pupils have learned to add columns, the sums of which do not exceed 50. Longer columns, with sums increasing until 100 is reached, should now be taken. The

number relations should be based on the fundamental combinations and the tables of endings.

Note. — Accuracy and time tests should be taken frequently. The following are a few suggestive exercises.

The teacher dictates, and the pupils give the answers orally :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
1.	78	65	47	63	47	54	45	72
	<u>9</u>	<u>7</u>	<u>6</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>7</u>	<u>9</u>
2.	37	59	65	82	45	67	77	84
	<u>8</u>	<u>7</u>	<u>9</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>9</u>	<u>3</u>
3.	49	68	78	89	97	49	56	76
	<u>9</u>	<u>7</u>	<u>5</u>	<u>4</u>	<u>6</u>	<u>8</u>	<u>5</u>	<u>9</u>
4.	85	77	84	65	39	48	62	81
	<u>9</u>	<u>5</u>	<u>9</u>	<u>4</u>	<u>8</u>	<u>8</u>	<u>7</u>	<u>8</u>
5.	34	82	79	35	69	76	88	79
	<u>8</u>	<u>5</u>	<u>6</u>	<u>9</u>	<u>7</u>	<u>6</u>	<u>9</u>	<u>9</u>

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	8	5	3	9	5
	<u>9</u>	<u>8</u>	<u>7</u>	<u>8</u>	<u>8</u>
	7	6	9	3	9
	<u>5</u>	<u>9</u>	<u>6</u>	<u>8</u>	<u>3</u>
	8	8	8	9	7
	<u>3</u>	<u>4</u>	<u>8</u>	<u>5</u>	<u>9</u>
	6	8	4	6	7
	<u>5</u>	<u>3</u>	<u>7</u>	<u>6</u>	<u>3</u>
	8	0	5	7	9
	<u>4</u>	<u>8</u>	<u>9</u>	<u>9</u>	<u>8</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
2.	8	5	9	4	8
	4	7	8	7	9
	6	5	0	8	7
	4	9	3	9	8
	7	9	9	8	9
	8	7	9	4	8
	5	8	9	0	8
	9	0	7	9	6
	9	8	6	9	8
	7	7	7	8	7
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
3.	8	9	6	9	8
	4	7	9	8	7
	5	9	7	5	9
	9	9	0	7	9
	8	3	5	9	6
	4	9	7	4	5
	8	9	4	9	7
	5	9	8	9	8
	7	6	8	9	5
	8	7	7	5	8
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
4.	28	85	79	64	78
	95	39	85	47	65
	72	83	37	95	62
	29	75	63	83	47
	37	29	54	63	29
	75	89	39	42	65
	83	29	65	70	92
	46	50	92	27	86
	78	29	65	83	46
	95	83	42	69	78
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	49	68	72	85	63
	87	49	58	69	78
	68	45	83	72	85
	75	89	70	69	87
	29	36	45	67	29
	76	59	47	83	67
	95	87	85	75	76
	29	28	37	63	49
	82	37	75	87	99
	77	66	88	99	66

6. Arrange in columns, and add :

$$a. 84 + 79 + 83 + 9 + 27 + 79 + 86 + 59 + 28$$

$$b. 76 + 8 + 29 + 56 + 29 + 95 + 7 + 39 + 76$$

$$c. 84 + 75 + 69 + 7 + 18 + 29 + 35 + 83 + 6$$

$$d. 29 + 38 + 75 + 92 + 5 + 68 + 35 + 79 + 86$$

$$e. 95 + 76 + 36 + 47 + 86 + 72 + 65 + 72 + 29$$

$$f. 28 + 98 + 20 + 49 + 9 + 86 + 72 + 98 + 65$$

$$g. 86 + 77 + 65 + 47 + 59 + 7 + 79 + 64 + 86$$

Addition of 3 or more columns.

Example 1: Add 3657

498

7836

540

29

12,560

Arrange the numbers under each other, units under units, tens under tens, etc. Begin with the units and add. The sum is 30 units.

Write down 0 under units and carry the 3 tens to the tens column. Add.

The sum is 26 tens. Write down the 6 tens and carry the 2 hundreds

to the next, or hundreds column. Add. The sum is 25 hundreds. Write down the 5 hundreds and carry the 2 thousands to the next, or thousands column. Add. The sum is 12 thousands, which is written down under thousands.

Example 2: Add $756 + 3269 + 847 + 29$.

$$\begin{array}{r}
 756 \\
 3269 \\
 847 \\
 \underline{29} \\
 4901
 \end{array}$$

EXERCISE

Add:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	3279	759	8365	7283
	865	2983	5670	793
	9265	859	329	2658
	729	38	4729	8309
	84	6475	79	836
	<u>6329</u>	<u>499</u>	<u>765</u>	<u>29</u>
2.	6850	429	3765	8693
	298	5683	7839	2760
	4035	72	836	509
	783	2659	3083	596
	29	783	498	6783
	9834	8656	7659	2659
	<u>769</u>	<u>3208</u>	<u>4323</u>	<u>7838</u>
3.	6583	2968	7568	4659
	2839	765	29	356
	646	7359	8563	9476
	7838	9695	3846	958
	783	294	656	3659
	79	85	2609	438
	3629	5436	79	8368
	<u>785</u>	<u>6383</u>	<u>2959</u>	<u>1765</u>

4. Arrange in columns, and add :

$$a. 3647 + 289 + 5678 + 439 + 57 + 8365 + 27$$

$$b. 9648 + 3287 + 297 + 483 + 6287 + 29 + 9837$$

$$c. 469 + 6389 + 2478 + 498 + 5683 + 72 + 6589$$

$$d. 7295 + 864 + 7263 + 29 + 4583 + 756 + 295$$

$$e. 6273 + 496 + 8569 + 37 + 4989 + 7265 + 939$$

$$f. 729 + 6584 + 2947 + 78 + 3658 + 429 + 6500$$

$$g. 4386 + 293 + 647 + 7291 + 8564 + 72 + 7878$$

$$h. 2965 + 473 + 7893 + 8937 + 4936 + 39 + 6858$$

Example: Add \$36.75 + \$2.37 + \$68.49 + \$8.78.

Arrange in columns, the dollars under dollars and the cents under cents.

\$36.75

2.37

68.49

8.78

\$116.39

Begin at the right-hand figure and add as in ordinary addition, carrying in each case to the next column on the left.

EXERCISE

Add:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	\$8.29	\$75.36	\$29.45	\$38.95
	29.45	7.89	8.83	19.25
	7.26	29.35	78.29	45.63
	13.25	28.37	9.25	6.20
	<u>2.75</u>	<u>6.25</u>	<u>7.38</u>	<u>2.95</u>
2.	\$39.75	\$87.25	\$7.65	\$27.85
	13.95	7.78	83.29	65.73
	27.45	26.36	17.45	29.69
	43.76	62.75	26.63	63.17
	<u>7.25</u>	<u>3.65</u>	<u>2.87</u>	<u>6.56</u>

Arrange in columns, and add :

3. a. $\$6.25 + \$38.75 + \$29.35 + \$7.79 + \$28.37$
 b. $\$29.37 + \$7.83 + \$87.65 + \$29.36 + \$65.38$
 c. $\$64.89 + \$26.47 + \$7.39 + \$8.75 + \$64.75 + \9
 d. $\$85.65 + \$72.75 + \$6.95 + \$67.83 + \$73.85 + \8
 e. $\$783.25 + \$654.65 + \$7.98 + \$39.65 + \$257.83 + \7

4. A boy spent \$4.75 for a pair of shoes, \$23.25 for a suit, \$1.75 for a cap, and \$18.95 for an overcoat. How much money did he spend altogether?

5. A woman sold some turkeys for \$16.45, chickens for \$23.85, geese for \$22.70, and ducks for \$9.85. How much money did she get for all?

6. Robert sold a calf for \$13.75, a pig for \$26.35, a lamb for \$9.65, two turkeys for \$5.75, and some chickens for \$15.30. How much money did he receive for all?

7. Kate bought a doll for \$3.75, a doll's carriage for \$6.35, a doll's house for \$8.75, and a wagon for \$15.65. What did all the articles cost her?

SUBTRACTION

Alternative Method.

Example 1: Find the difference between 3256 and 1879.

PROCESS

3256 1879 <hr style="width: 100px; margin: 0;"/> 1377	Write the smaller number under the larger, placing units under units, tens under tens, etc. Begin at the units column. Since 9 is greater than 6, think 9 and 7 are 16. Write down 7 in the units column. Carry 1 to 7 in the tens column, which makes 8. Since 8 is greater than 5, think 8 and 7 are 15. Write down 7 in the tens column. Carry 1 to 8 in the hundreds column, making 9. Since 9 is greater than 2, think 9 and 3 are 12. Write down 3. Carry 1 to 1 in the thousands column, making 2. 2 and 1 are 3. Write down 1 in the thousands column.
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Check by adding 1377 and 1879; the sum is 3256

Example 2: Find the difference between 4206 and 2857.

$$\begin{array}{r} 4206 \\ 2857 \\ \hline 1349 \end{array}$$

Example 3: Find the difference between 4500 and 3657.

$$\begin{array}{r} 4500 \\ 3657 \\ \hline 843 \end{array}$$

Example 4: Find the difference between 4000 and 2867.

$$\begin{array}{r} 4000 \\ 2867 \\ \hline 1133 \end{array}$$

Example 5: Find the difference between \$384.25 and \$97.68.

$$\begin{array}{r} \$384.25 \\ 97.68 \\ \hline \$286.57 \end{array}$$

NOTE TO THE TEACHER. — It is advisable to teach *one* method only and to give practice in use of this, so that the work may be done with accuracy and with facility.

EXERCISE

Subtract and check :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	6283 <u>4358</u>	7569 <u>2673</u>	5832 <u>2678</u>	7683 <u>2595</u>	6325 <u>4587</u>
2.	8934 <u>5986</u>	7263 <u>5476</u>	6459 <u>3684</u>	5483 <u>2995</u>	6434 <u>2778</u>
3.	6242 <u>5787</u>	8353 <u>2976</u>	4354 <u>2985</u>	7483 <u>2698</u>	5239 <u>2587</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
4.	3583 <u>2697</u>	4323 <u>2678</u>	5838 <u>2959</u>	4326 <u>2769</u>	5273 <u>2695</u>
5.	6504 <u>2875</u>	7206 <u>2957</u>	6043 <u>2594</u>	7036 <u>2988</u>	2058 <u>1679</u>
6.	7204 <u>3678</u>	5028 <u>4399</u>	6075 <u>2886</u>	7040 <u>2865</u>	6400 <u>5837</u>
7.	6500 <u>2938</u>	7250 <u>2875</u>	6034 <u>2856</u>	5040 <u>2697</u>	8640 <u>2965</u>
8.	5000 <u>2873</u>	6200 <u>4583</u>	7600 <u>2856</u>	6200 <u>5837</u>	4000 <u>2967</u>
9.	5210 <u>2876</u>	6150 <u>2479</u>	7100 <u>2647</u>	5102 <u>2647</u>	6000 <u>2865</u>
10.	4205 <u>2987</u>	31006 <u>28459</u>	72005 <u>36586</u>	42100 <u>28365</u>	62100 <u>28357</u>
11.	\$384.25 <u>\$175.69</u>	\$523.32 <u>\$289.76</u>	\$623.15 <u>\$285.78</u>	\$683.35 <u>\$295.78</u>	
12.	\$290.25 <u>\$196.68</u>	\$500.00 <u>\$286.63</u>	\$683.00 <u>\$285.76</u>	\$400.00 <u>\$263.79</u>	

13. Find the difference between :

a. 6710 and 3859

e. \$256.25 and \$89.97

b. 21064 and 8965

f. \$506.15 and \$329.78

c. 17608 and 9759

g. \$700.00 and \$89.85

d. 11200 and 8467

h. \$650.00 and \$135.68

14. Add and subtract :

$$36847 + 483 - 5643 + 2647 - 3847 + 593 - 8475$$

15. Add and subtract :

$$\begin{aligned} \$285.75 + \$583.95 - \$89.35 + \$68.45 - \$347.83 \\ + \$229.68 - \$228.76 \end{aligned}$$

PROBLEMS

1. BILL OF FARE AT A RESTAURANT

Soup	15¢	Meat	32¢
Fish	24¢	Sandwich	16¢
Potatoes	8¢	Pudding	10¢
Bread and Butter	12¢	Tea, Coffee	5¢
Pie	10¢	Milk	5¢

Father, Mother, and the 4 children took lunch down town.

(a) Mary chose soup, bread and butter, sandwich, and milk. Find the cost of her lunch.

(b) Tom had fish, potatoes and pudding. What did his lunch cost?

(c) Kate had meat, bread and butter, pudding, and milk. What did her lunch cost?

(d) Eric had soup, fish, bread and butter, pudding, and milk. What did his lunch cost?

(e) Mother had soup, meat, potatoes, pudding, and tea. What was the cost of her lunch?

(f) Father had soup, fish, potatoes, bread and butter, pie, and coffee. What did he pay for his lunch?

(g) Find the total cost of the lunch for the family.

2. Harry earned 45 cents. He put it in his bank with 39 cents he already had. How much has he now in the bank?

3. Robert bought a horse for \$65, a saddle for \$16, and a bridle for \$8. How much money did he pay for all?

4. On Monday Frank sold 18 papers, on Tuesday 29 papers, and on Wednesday 35 papers. How many papers did he sell during the three days?

5. Margaret had \$5.00. She spent \$2.25 for a hat. How much money did she have left?

6. Jane is 16 years old, and Annie is 7 years younger. How old is Annie?

7. Harold had 138 pigeons. He sold 89 of them. How many pigeons has he left?

8. William's father owned 356 sheep. He sold 287 of them. How many sheep has he now?

9. Fred weighs 78 lbs., and Charles weighs 82 lbs. How much heavier is Charles than Fred?

MULTIPLICATION AND DIVISION

TABLE OF 2's

Introductory. Count by 2's to 10, 20, 16, 24, etc. How many twos are in 12, 20, 24, 14, 16, 8, etc.?

Give at sight:

2	4	6	10	3	7	9	5	11	8	12
<u>2</u>	<u>4</u>	<u>6</u>	<u>10</u>	<u>3</u>	<u>7</u>	<u>9</u>	<u>5</u>	<u>11</u>	<u>8</u>	<u>12</u>

Study:

2	2	2	2	2	2
	2	2	2	2	2
		2	2	2	2
			2	2	2
				2	2
					2
<u>2</u>	<u>4</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>12</u>

Give the answers :

What are : 7 twos? 3 twos? 11 twos? 9 twos? 6 twos?
8 twos? 12 twos?

Learn:

2 times 1 are 2	1 times 2 are 2
2 times 2 are 4	2 times 2 are 4
2 times 3 are 6	3 times 2 are 6
2 times 4 are 8	4 times 2 are 8
2 times 5 are 10	5 times 2 are 10
2 times 6 are 12	6 times 2 are 12
2 times 7 are 14	7 times 2 are 14
2 times 8 are 16	8 times 2 are 16
2 times 9 are 18	9 times 2 are 18
2 times 10 are 20	10 times 2 are 20
2 times 11 are 22	11 times 2 are 22
2 times 12 are 24	12 times 2 are 24

DRILL — ORAL

1. What are 2 sixes? 2 eights? 2 sevens? etc.
2. Give the answers: 2×6 , 2×8 , 2×4 , 2×10 , 2×11 , 2×5 , 2×3 , 2×7 , 2×12 , 2×2 , 2×9 .

3. Give the answers.

Example: $2 \times 4 + 3$ read 2 times 4 and 3 = 11.

$2 \times 6 + 2$	$2 \times 7 + 5$	$2 \times 9 + 3$	$2 \times 11 + 6$
$2 \times 7 + 3$	$2 \times 8 + 6$	$2 \times 10 + 7$	$2 \times 4 + 5$
$2 \times 9 + 5$	$2 \times 12 + 3$	$2 \times 5 + 6$	$2 \times 3 + 7$

4. How many twos are there in 18, 6, 12, 24, 16, 8, 10, 14, 22, 4?

5. How many twos are there in 21, 15, 11, 17, 7, 19, 25, 13, 9, 23?

6. Tom sold 7 papers at 2 cents each. How much money did he get for them?

7. Apples cost 2 cents each. How many apples can I buy for 10 cents? for 20 cents? for 24 cents?

8. There are 7 girls in the class and twice as many boys as girls. How many boys are in the class?

9. Mary had 16 oranges, and she gave 2 to each child in her class. How many children were in the class?

10. John bought 2 sheep, paying \$9 for each. How much did the sheep cost him?

NOTE TO THE TEACHER. Frequent, rapid drills on the tables are required in order that these may be mastered by the pupils.

Multiplication by 2.

Example: Multiply 367 by 2.

Two times 7 units are 14 units = 1 ten 4 units. Write down 4 units under units and carry 1 ten. Two times 6 tens are 12 tens, and carrying 1 ten makes 13 tens = 1 hundred 3 tens. Write down 3 tens under tens and carry 1 hundred. Two times 3 hundreds are 6 hundreds, and carrying 1 hundred makes 7 hundreds. Write down 7 hundreds.

Note. The sign of multiplication is \times .

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	647	529	645	327	593
	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
2.	356	479	369	580	275
	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	259	396	468	756	709
	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$

4.	894	960	708	530	986
	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$

5. Ralph has 2 acres of potatoes. He digs 239 bushels from each acre. How many bushels does he get from 2 acres?

6. Bertha has 2 flocks of chickens with the same number in each flock. If there are 378 in one flock, how many chickens has she?

7. Marbles are 2 for 1 cent. How many marbles can Eric buy with 12 cents?

8. Mary's mother buys 2 quarts of milk each day. How many quarts of milk does she buy in a week?

9. A farmer sold 11 quarts of milk. How many pints of milk did he sell?

10. Tom has \$49, and William has twice as much as Tom. How much money has William?

Division by 2.

Example 1: Divide 4274 by 2.

2137 *Ans.* Begin at the left-hand figure. Four thousands divided by 2 is 2 thousands. Write down 2 above.
2)4274 Two hundreds divided by 2 is 1 hundred. Write down 1 above. Seven tens divided by 2 is 3 tens and 1 over. Write down 3 tens and carry the 1 ten to units, making 14 units. 14 units divided by 2 is 7 units. Write down 7 units.

Example 2: Divide 3271 by 2.

$$\begin{array}{r} 1635 \quad 1 \text{ remainder.} \\ 2 \overline{)3271} \end{array}$$

Note. — The sign for division is \div .

If we divide a number by 2, the result is one-half the number or $\frac{1}{2}$ of the number.

To divide a number by 2, take $\frac{1}{2}$ of it, or to find $\frac{1}{2}$ of a number divide it by 2.

EXERCISE

Divide by 2:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	4684	6842	8648	4866	8486
2.	5472	3684	9436	5638	2636
3.	64392	95812	43752	6732	2504
4.	7002	8300	4950	7250	6430

Find $\frac{1}{2}$ of each of the following numbers:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	648	3264	7538	2064	7500
6.	43750	9300	4700	2572	6300

7. A farmer had 456 sheep. He put half of them in a field. How many sheep did he put in the field?

8. John earned \$98. He put $\frac{1}{2}$ of it in the bank. How much money has he left?

9. Mother divided 450 cents equally between Kate and Jane. How much money did each receive?

10. Harold had 530 chickens. He sold $\frac{1}{2}$ of them. How many chickens has he left?

TABLE OF 3's

Introductory.

Count by 3's to 15, 24, 30, etc.

How many threes are there in 18, 21, 12, 9, 24, 30, 15, 27, 6, 36?

Give at sight :

2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11

Give the answers :

What are 3 threes? 7 threes? 9 threes; etc.

Learn :

3 times 1 are 3	1 times 3 are 3
3 times 2 are 6	2 times 3 are 6
3 times 3 are 9	3 times 3 are 9
3 times 4 are 12	4 times 3 are 12
3 times 5 are 15	5 times 3 are 15
3 times 6 are 18	6 times 3 are 18
3 times 7 are 21	7 times 3 are 21
3 times 8 are 24	8 times 3 are 24
3 times 9 are 27	9 times 3 are 27
3 times 10 are 30	10 times 3 are 30
3 times 11 are 33	11 times 3 are 33
3 times 12 are 36	12 times 3 are 36

ORAL DRILL

1. What are 3 nines? 3 sixes? 3 fours? 3 threes? 3 sevens? etc.

2. Give the answers :

3×6	$\times 9$	3×12	3×7	3×10
3×5	3×4	3×8	3×11	3×3

3. Give the answers :

$3 \times 6 + 2$	$3 \times 7 + 5$	$3 \times 9 + 4$	$3 \times 11 + 6$
$3 \times 7 + 3$	$3 \times 8 + 6$	$3 \times 10 + 7$	$3 \times 4 + 5$
$3 \times 9 + 5$	$3 \times 12 + 3$	$3 \times 5 + 6$	$3 \times 3 + 7$

4. How many threes are there in 21, 12, 15, 27, 36, 9, 30, 18, 24, 33 ?

5. How many threes are there in 31, 17, 26, 11, 7, 29, 14, 38, 35, 23, 16, 31 ?

6. Apples are worth 3 cents each. How many should I get for 30 cents ?

7. Robert's father bought 3 pigs at \$9 each. What did the pigs cost ?

8. Mary bought pencils at 3 cents each. How many pencils did she get for 18 cents ?

9. If oranges are worth 3 cents each, what is the cost of 1 dozen ?

10. Kate's mother bought 3 quarts of milk each day. What was the cost of the milk at 11 cents per quart ?

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	647	529	645	327	593
	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>
2.	356	479	369	580	275
	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>
3.	259	736	468	856	709
	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>
4.	894	960	708	530	986
	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>	<u>$\times 3$</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	6583	4063	9273	8567	5089
	<u>×3</u>	<u>×3</u>	<u>×3</u>	<u>×3</u>	<u>×3</u>

6. Leslie has \$349. Harry has 3 times as much money. How much money has Harry?

7. A farmer sold 3 sheep, receiving \$24.50 for each. How much money did he get for the sheep?

8. Tom buys marbles at 3 for 1 cent. How much will 75 marbles cost?

9. What is the cost of 3 lbs. of butter at 69 cents per pound?

10. A farmer sold 279 bushels of special seed wheat at \$3 per bushel. How much money did he get for the wheat?

To find one third ($\frac{1}{3}$) of a number divide it by 3.

EXERCISE

Divide by 3 :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	911	12738	2262	1584	7059
2.	14037	2607	17502	2094	17517
3.	2307	1782	10221	16227	11721
4.	20427	16311	25212	8595	14724

Find $\frac{1}{3}$ of each of the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	11541	27249	12279	2691	17511
6.	8427	29421	26811	14964	17022

7. A farmer had 837 sheep. He sold $\frac{1}{3}$ of them. How many sheep did he sell?

8. There are 3 feet in one yard. How many yards long is a walk that measures 33 feet?

9. A strip of carpet is 1 yard wide. How many strips of carpet will be required for a room 24 feet wide?

10. A man bought 3 acres of land, paying \$81. What is the price of 1 acre?

TABLE OF 4's

Introductory. Count by 4's to 16, 24, 32, etc.

How many fours are there in 20, 28, 36, 8, 16, 44? etc.

Give at sight :

2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11

Give the answers :

What are 4 fours? 7 fours? 9 fours? etc.

Learn :

4 times 1 are 4	1 times 4 are 4
4 times 2 are 8	2 times 4 are 8
4 times 3 are 12	3 times 4 are 12
4 times 4 are 16	4 times 4 are 16
4 times 5 are 20	5 times 4 are 20
4 times 6 are 24	6 times 4 are 24
4 times 7 are 28	7 times 4 are 28
4 times 8 are 32	8 times 4 are 32
4 times 9 are 36	9 times 4 are 36
4 times 10 are 40	10 times 4 are 40
4 times 11 are 44	11 times 4 are 44
4 times 12 are 48	12 times 4 are 48

ORAL DRILL

1. What are 4 nines? 4 sixes? 4 fours? 4 threes? 4 sevens? etc.

2. Give the answers:

$$\begin{array}{ccccc} 4 \times 6 & 4 \times 9 & 4 \times 12 & 4 \times 7 & 4 \times 10 \\ 4 \times 5 & 4 \times 4 & 4 \times 8 & 4 \times 11 & 4 \times 3 \end{array}$$

3. Give the answers:

$$\begin{array}{cccc} 4 \times 6 + 2 & 4 \times 7 + 5 & 4 \times 9 + 4 & 4 \times 11 + 6 \\ 4 \times 7 + 3 & 4 \times 8 + 6 & 4 \times 10 + 7 & 4 \times 4 + 5 \\ 4 \times 9 + 5 & 4 \times 12 + 3 & 4 \times 5 + 6 & 4 \times 3 + 7 \end{array}$$

4. How many fours are there in 20, 28, 36, 12, 44?

5. How many fours are there in 21, 17, 26, 31, 11, 38, 14, 19?

6. Peaches are sold at 4 cents each. How many should I get for 40 cents?

7. A farmer bought 4 sheep at \$12 each. What did the sheep cost?

8. Anne bought pencils at 4 cents each. How many did she get for 24 cents?

9. If lemons are sold at 4 cents each, what is the cost of 1 dozen?

10. A family used 4 quarts of milk each day. What was the cost of the milk at 12 cents per quart?

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	647	529	645	327	593
	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>
2.	356	479	369	580	275
	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>	<u>$\times 4$</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	259 <u>×4</u>	736 <u>×4</u>	468 <u>×4</u>	856 <u>×4</u>	709 <u>×4</u>
4.	894 <u>×4</u>	960 <u>×4</u>	708 <u>×4</u>	530 <u>×4</u>	986 <u>×4</u>
5.	6583 <u>×4</u>	4060 <u>×4</u>	9273 <u>×4</u>	8567 <u>×4</u>	5089 <u>×4</u>

6. Robert has \$487. Harry has 4 times as much money. How much money has Harry?

7. A farmer sold 4 sheep, receiving \$24.50 for each. How much money did he get for the sheep?

8. Tom buys marbles at 4 for 1 cent. What will 72 marbles cost?

9. What is the cost of 4 lbs. of cheese at 19 cents per lb.?

10. A farmer sold 279 bushels of seed wheat at \$4 per bushel. How much money did he get for the wheat?

To find one-fourth ($\frac{1}{4}$) of a number, divide it by 4.

EXERCISE

Divide by 4:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	844	904	2384	11232	70942
2.	14092	15608	3264	90604	16024
3.	2308	96054	90752	50944	5084
4.	60924	98732	68704	67484	13728

Find $\frac{1}{4}$ of each of the following numbers:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	
5.	11504	27432	26492	1604	70584
6.	84084	67944	2104	73212	18916

7. A farmer had 1024 sheep. He sold $\frac{1}{4}$ of them. How many sheep did he sell?

8. There are 4 quarts in a gallon. How many gallons are there in a tank containing 168 quarts?

TABLE OF 5's

Introductory. Count by 5's to 20, 35, 45, 60, 15, 55, 30, 40, 25, 55.

How many *fives* are there in 25, 40, 55, 15, 35, 45, 10, 30, 60?

Give at sight :

2	4	6	10	3	7	9	5	11	8	12
2	4	6	10	3	7	9	5	11	8	12
2	4	6	10	3	7	9	5	11	8	12
2	4	6	10	3	7	9	5	11	8	12
2	4	6	10	3	7	9	5	11	8	12

Give the answers :

What are 6 fives? 9 fives? 10 fives? 3 fives? 12 fives?
7 fives? 11 fives? 8 fives?

Learn :

5 times 1 are 5	1 times 5 are 5
5 times 2 are 10	2 times 5 are 10
5 times 3 are 15	3 times 5 are 15
5 times 4 are 20	4 times 5 are 20
5 times 5 are 25	5 times 5 are 25
5 times 6 are 30	6 times 5 are 30
5 times 7 are 35	7 times 5 are 35
5 times 8 are 40	8 times 5 are 40
5 times 9 are 45	9 times 5 are 45
5 times 10 are 50	10 times 5 are 50
5 times 11 are 55	11 times 5 are 55
5 times 12 are 60	12 times 5 are 60

ORAL DRILL

1. What are 5 eights? 5 sixes? 5 nines? 5 sevens? 5 threes? 5 tens? etc.

2. Give the answers:

$$5 \times 7 \quad 5 \times 10 \quad 5 \times 8 \quad 5 \times 3 \quad 5 \times 9 \quad 5 \times 6 \quad 5 \times 12, \text{ etc.}$$

3. Give the answers:

$$\begin{array}{cccc} 5 \times 6 + 2 & 5 \times 7 + 3 & 5 \times 9 + 3 & 5 \times 11 + 6 \\ 5 \times 7 + 5 & 5 \times 8 + 6 & 5 \times 10 + 7 & 5 \times 4 + 5 \\ 5 \times 9 + 6 & 5 \times 12 + 3 & 5 \times 5 + 6 & 5 \times 3 + 7 \end{array}$$

4. How many *fives* are there in 25, 40, 60, 15, 35, 10, 45, 30, 55, 20, 50?

5. How many *fives* are there in 36, 23, 17, 29, 38, 43, 24, 53, 9, 19, 11, 58?

6. Arthur sold 12 newspapers at 5 cents each. How much money did he receive for them?

7. Mary bought 7 books at 5 cents each. How much money did she pay for them?

8. A flower bed is 9 feet wide. It is five times as long as it is wide. How long is the bed?

9. There are 6 girls in a class, and there are five times as many boys as girls. How many boys are there in the class?

10. Robert saves \$5 a week. How much money will he save in 8 weeks?

EXERCISE

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1. 6893	5476	2835	7293	6485
$\times 5$	$\times 5$	$\times 5$	$\times 5$	$\times 5$
2. 3567	4793	3696	5809	2757
$\times 5$	$\times 5$	$\times 5$	$\times 5$	$\times 5$

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	8293 <u>×5</u>	3763 <u>×5</u>	4685 <u>×5</u>	5739 <u>×5</u>	7093 <u>×5</u>
4.	8947 <u>×5</u>	9607 <u>×5</u>	7083 <u>×5</u>	5308 <u>×5</u>	9867 <u>×5</u>

5. A man had 14 cows. He kept 9 of them and sold the remainder at \$69 each. How much did he get for the cows he sold?

6. John set out 5 rows of celery plants. There are 78 plants in each row. How many plants did he set out?

7. A farmer bought 5 horses at \$275 each. What did the horses cost?

8. A man saves \$63 per month. How much money will he save in 5 months?

9. A man drives 5 hours in a motor car going 28 miles an hour. How far does he go in 5 hours?

To find one-fifth ($\frac{1}{5}$) of a number divide it by 5.

EXERCISE

Divide by 5:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	6340	25810	7290	8565	7265
2.	7285	39215	29835	64730	8295
3.	69210	24840	62860	72950	18260
4.	700020	51020	43750	26930	62710

Find $\frac{1}{5}$ of each of the following numbers:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	26400	35240	42930	17560	12465
6.	78300	64200	82515	72630	46530

7. A man earned \$2850 in a year. He saved $\frac{1}{5}$ of this. How much money did he save?

8. A farmer bought lambs at \$5 each. How many lambs should he get for \$350.00?

TABLE OF 6's

Introductory. Count by 6's to 24, 42, 48, 60, etc.

How many sixes are there in 18, 30, 12, 36, 54? etc.

Give at sight:

2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11
2	4	6	10	3	7	12	9	5	8	11

Give the answers:

What are 4 sixes? 7 sixes? 9 sixes? etc.

Learn:

6 times 1 are 6	1 times 6 are 6
6 times 2 are 12	2 times 6 are 12
6 times 3 are 18	3 times 6 are 18
6 times 4 are 24	4 times 6 are 24
6 times 5 are 30	5 times 6 are 30
6 times 6 are 36	6 times 6 are 36
6 times 7 are 42	7 times 6 are 42
6 times 8 are 48	8 times 6 are 48
6 times 9 are 54	9 times 6 are 54
6 times 10 are 60	10 times 6 are 60
6 times 11 are 66	11 times 6 are 66
6 times 12 are 72	12 times 6 are 72

ORAL DRILL

1. What are 6 nines? 6 sixes? 6 fours? 6 threes? 6 sevens? etc.

2. Give the answers:

6×6 6×8 6×12 6×4 6×10 6×7 etc.

3. Give the answers:

$6 \times 7 + 6$	$6 \times 7 + 3$	$6 \times 7 + 3$	$6 \times 10 + 5$
$6 \times 5 + 8$	$6 \times 4 + 8$	$6 \times 2 + 9$	$6 \times 12 + 3$
$6 \times 9 + 2$	$6 \times 3 + 5$	$6 \times 3 + 4$	$6 \times 11 + 6$

4. How many sixes are there in 18, 36, 48, 12, 30?

5. How many sixes are there in 17, 26, 31, 43, 35, 20, 25?

6. Apples are sold at 6 cents each. How many should I get for 54 cents?

X 7. Leslie's father bought 6 pigs at \$12 each. What did the pigs cost him?

8. Mary bought pencils at 6 cents each. How many did she get for 48 cents?

X 9. If oranges are sold at 6 cents each, what is the cost of 9 oranges?

10. A train travels 834 miles a day. How far will it travel in 6 days?

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	684	904	616	327	589
	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>
2.	356	697	387	493	573
	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>	<u>$\times 6$</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	259 <u>×6</u>	687 <u>×6</u>	382 <u>×6</u>	317 <u>×6</u>	867 <u>×6</u>
4.	1234 <u>×6</u>	6320 <u>×6</u>	6538 <u>×6</u>	948 <u>×6</u>	657 <u>×6</u>
5.	7956 <u>×6</u>	1978 <u>×6</u>	6587 <u>×6</u>	7825 <u>×6</u>	3642 <u>×6</u>

6. Harry has 9 sheep, and James has 6 times as many as Harry. How many sheep has James?

7. A farmer sold 6 loads of wheat for \$54.90 a load. How much money did he receive?

8. John saved \$6 a month. How much money did he save in a year?

9. Milk is sold at 6 cents per pint. What is the cost of 67 pints?

10. A restaurant uses 6 bushels of potatoes a day. How many bushels of potatoes will it use in 66 days?

To find one-sixth ($\frac{1}{6}$) of a number divide it by 6.

EXERCISE

Divide by 6:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	18678	10560	20232	5280	96126
2.	1266	30792	12452	59646	70206
3.	13674	69408	11322	1086	10092
4.	59682	7806	61044	19652	10038

Find $\frac{1}{6}$ of each of the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5.	69402	29646	29844	1632	40506
6.	10014	9708	11124	63360	5280

7. A farmer had 6 acres in potatoes from which he dug 1074 bushels. How many bushels did he get from each acre?

8. Leslie gathers 6 eggs a day. How long will it take him to gather 5 dozen eggs?

9. A quart of ice cream will serve 6 persons. How many quarts should be ordered for 252 persons?

10. John's father bought lambs at \$6 each, paying \$1404. How many lambs did he buy?

TABLE OF 7's

Introductory. Count by 7's to 21, 35, 49, 56, 63, 70.
28, 42, 77, 84.

How many *serens* are there in 35, 28, 63, 49, 56, 70, 42, 84, 77, 14, 21?

Give at sight :

[illegible]

Give the answers :

What are 6 sevens? 8 sevens? 7 sevens? 10 sevens?
3 sevens? etc.

Learn :

7 times 1 are 7	1 times 7 are 7
7 times 2 are 14	2 times 7 are 14
7 times 3 are 21	3 times 7 are 21
7 times 4 are 28	4 times 7 are 28
7 times 5 are 35	5 times 7 are 35
7 times 6 are 42	6 times 7 are 42
7 times 7 are 49	7 times 7 are 49
7 times 8 are 56	8 times 7 are 56
7 times 9 are 63	9 times 7 are 63
7 times 10 are 70	10 times 7 are 70
7 times 11 are 77	11 times 7 are 77
7 times 12 are 84	12 times 7 are 84

ORAL DRILL

1. What are 7 eights? 7 nines? 7 threes? 7 sixes?
7 twelves? 7 sevens? etc.

2. Give the answers :

7×6	7×9	7×12	7×3	7×8
7×4	7×7	7×10	7×2	etc.

3. Give the answers :

$7 \times 6 + 4$	$7 \times 8 + 5$	$7 \times 11 + 6$	$7 \times 10 + 4$
$7 \times 7 + 8$	$7 \times 12 + 4$	$7 \times 4 + 8$	$7 \times 8 + 4$
$7 \times 9 + 5$	$7 \times 3 + 7$	$7 \times 5 + 9$	$7 \times 9 + 8$

4. How many *sevens* are in 42, 63, 14, 49, 77, 56, 21,
35, 70, 28, 84?

5. How many *sevens* are there in 37, 24, 17, 68, 51, 46, 87, 29, 54, 61, 75?

6. Helen had 9 weeks vacation. How many days vacation did she have?

7. If bread costs 7 cents a loaf, find the cost of 7 loaves.

8. Charles sold 12 pigs at \$7 each. How much did he receive for them?

9. Edwin saved \$7 per month for 8 months. How much money has he saved altogether?

10. A boy walks 7 miles per day for 4 days. How many miles did he walk?

EXERCISE

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	6893 <u>×7</u>	5476 <u>×7</u>	2835 <u>×7</u>	7293 <u>×7</u>	6485 <u>×7</u>
2.	3567 <u>×7</u>	4793 <u>×7</u>	3698 <u>×7</u>	5809 <u>×7</u>	2759 <u>×7</u>
3.	8293 <u>×7</u>	3768 <u>×7</u>	4685 <u>×7</u>	5739 <u>×7</u>	7093 <u>×7</u>
4.	8947 <u>×7</u>	9608 <u>×7</u>	7089 <u>×7</u>	5983 <u>×7</u>	9867 <u>×7</u>
5.	36587 <u>×7</u>	62908 <u>×7</u>	48397 <u>×7</u>	56006 <u>×7</u>	29683 <u>×7</u>

6. How many days are there in 39 weeks?

7. John saved \$19 each month for 7 months. How much money did he save?

8. Mary picked 59 quarts of berries each week. How many quarts of berries did she pick in 7 weeks?

9. A woman uses 7 pints of milk each day. How many pints of milk will she use in 1 year (365 days)?

10. It is 47 weeks to Christmas. How many days is it to Christmas?

To find one-seventh ($\frac{1}{7}$) of a number divide it by 7.

EXERCISE

Divide by 7 :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1. 18781	6881	20263	68845	21609
2. 27342	6779	16492	20356	6811
3. 13559	19922	53445	65142	20881
4. 59444	25942	9786	27496	58765

Find $\frac{1}{7}$ of each of the following numbers :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
5. 44849	29649	20566	47663	26096
6. 27356	9709	20517	51037	38052

7. Gordon bought sheep at \$7 each. How many sheep should he get for \$973?

8. A farmer sold 203 quarts of milk in 1 week. How much milk did he sell in one day?

9. It is 133 days since New Year's day. How many weeks is it since the beginning of the year?

10. Mary's father earned \$3220 each year. He saved $\frac{1}{7}$ of what he earned. How much money did he save in a year?

TABLE OF 8's

Introductory.

Count by 8's to 24, 32, 56, 48, 40, 16, 72, 88, 96, 64.

How many 8's are there in 40, 16, 72, 64, 24, 32, 80, 96, 56?

Give at sight :

8	9	10	11	12
8	9	10	11	12
8	9	10	11	12
8	9	10	11	12
8	9	10	11	12
8	9	10	11	12
8	9	10	11	12
8	9	10	11	12

Review :

8 times 5	8 times 7	8 times 6
8 times 2	8 times 3	8 times 4

What are 8 nines? 8 twelves? 8 eights? 8 elevens?
8 tens?

Learn :

8 times 8 are 64	9 times 8 are 72
8 times 9 are 72	10 times 8 are 80
8 times 10 are 80	11 times 8 are 88
8 times 11 are 88	12 times 8 are 96
8 times 12 are 96	

ORAL DRILL

1. What are 8 nines? 8 fives? 8 sevens? 8 sixes?
8 twelves? etc.

2. Give the answers :

8×9	8×11	8×7	8×8
8×4	8×12	8×3	8×5 etc.

3. Give the answers :

$8 \times 7 + 5$	$8 \times 5 + 7$	$8 \times 2 + 5$	$8 \times 10 + 7$
$8 \times 9 + 4$	$8 \times 3 + 6$	$8 \times 11 + 9$	$8 \times 8 + 5$
$8 \times 6 + 7$	$8 \times 4 + 9$	$8 \times 12 + 6$	$8 \times 9 + 6$

4. How many *eights* are there in 56, 72, 16, 24, 32, 40, 88, 48, 64, 80, 96?

5. How many *eights* are there in 31, 29, 75, 19, 68, 39, 46, 82, 101, 58, 62?

6. Milk is sold at 8 cents a pint. Find the cost of 9 pints.

7. Jane bought 7 books at 8 cents each. How much did she pay for the books?

8. A boy sold 12 papers at 8 cents each. How much did he receive?

9. A farmer bought 8 sheep at \$8 each. What did the sheep cost?

10. A man drove 8 miles an hour for 7 hours. How many miles did he travel?

Multiply :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	$\begin{array}{r} 5476 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 2835 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 7293 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 6485 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 9834 \\ \times 8 \\ \hline \end{array}$
2.	$\begin{array}{r} 3567 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 4793 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 3698 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 5809 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 2759 \\ \times 8 \\ \hline \end{array}$
3.	$\begin{array}{r} 8947 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 9608 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 7089 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 5983 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 9867 \\ \times 8 \\ \hline \end{array}$

4.	36587 <u>×8</u>	62908 <u>×8</u>	48397 <u>×8</u>	56706 <u>×8</u>	29638 <u>×8</u>
5.	8293 <u>×8</u>	3768 <u>×8</u>	4685 <u>×8</u>	5739 <u>×8</u>	7093 <u>×8</u>

6. A man earns \$8 per day. How much did he earn in 27 days?

7. Robert saved \$8 a month for 18 months. How much money did he save?

8. A farmer sold 47 pigs at \$8 each. How much did he receive for them?

9. A shoe dealer bought 35 pairs of shoes at \$8 per pair. How much did the shoes cost him?

10. A man drives his motor car at the rate of 29 miles an hour. How far does he travel in 8 hours?

To find one-eighth ($\frac{1}{8}$) of a number divide it by 8.

Divide by 8:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	3032	42776	7864	6112	7256
2.	3656	7576	29352	111032	52864
3.	91272	285040	753168	23048	43176
4.	26583	729638	22438	62897	58395
5.	726109	326193	58343	26478	360934

Find $\frac{1}{8}$ of each of the following numbers:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
6.	98635	739832	958637	274839	658473
7.	358073	198356	42359	376578	540657

8. A farmer bought some calves at \$8 each. He paid \$592 for them. How many calves did he buy?

9. The wages of 8 men for a month amounted to \$1344. How much did each man earn in the month?

10. A woman bought 8 yards of cloth, paying \$10.80 for it. What did the cloth cost her per yard?

11. A farmer stores his wheat in 8 bins of equal size. If he has 3480 bushels of wheat, how many bushels are in each bin?

TABLE OF 9's

Introductory.

Count by 9's to 27, 54, 90, 45, 63, 72, 18, 99, 36, 108, 81.

How many 9's are there in 45, 72, 81, 99, 63, 108, 36? etc

Review :	9 times 2	9 times 7	9 times 3
	9 times 4	9 times 6	9 times 5
	9 times 8		

Give at sight :	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12
	9	10	11	12

What are 9 nines? 9 tens? 9 elevens? 9 twelves?

Learn:

9 times 9 are 81	10 times 9 are 90
9 times 10 are 90	11 times 9 are 99
9 times 11 are 99	12 times 9 are 108
9 times 12 are 108	

ORAL DRILL

1. What are 9 sevens? 9 sixes? 9 nines? 9 threes?
9 elevens? 9 eights? etc.

2. Give the answers :

$$\begin{array}{cccc} 9 \times 7 & 9 \times 5 & 9 \times 3 & 9 \times 9 \\ 9 \times 4 & 9 \times 6 & 9 \times 8 & 9 \times 10 \text{ etc.} \end{array}$$

3. Give the answers :

$$\begin{array}{ccc} 9 \times 7 + 5 & 9 \times 5 + 7 & 9 \times 10 + 7 \\ 9 \times 8 + 3 & 9 \times 3 + 6 & 9 \times 7 + 6 \\ 9 \times 4 + 5 & 9 \times 8 + 7 & 9 \times 9 + 3 \text{ etc.} \end{array}$$

4. How many *nines* are there in 36, 63, 72, 18, 108, 90, 45, 27?

5. How many *nines* are there in 42, 39, 76, 85, 22, 69, 93, 111?

6. Strawberries are sold at 9 cents per box. What is the price of 7 boxes?

7. What is the cost of 6 lbs. of sugar at 9 cents per lb.?

8. Harold bought 12 lbs. of candies for Christmas. He paid 9 cents per lb. for them. How much did he pay for the candies?

9. A man saves \$8 per week. How much will he save in 9 weeks?

10. Robert earns \$5 per week. What will he earn in 9 weeks?

Multiply :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	5476	2835	7293	6485	9834
	<u>×9</u>	<u>×9</u>	<u>×9</u>	<u>×9</u>	<u>×9</u>
2.	3567	4793	3698	5809	2759
	<u>×9</u>	<u>×9</u>	<u>×9</u>	<u>×9</u>	<u>×9</u>

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
3.	8947 <u>×9</u>	9608 <u>×9</u>	7089 <u>×9</u>	5983 <u>×9</u>	9867 <u>×9</u>
4.	36587 <u>×9</u>	62908 <u>×9</u>	48397 <u>×9</u>	5679 <u>×9</u>	9638 <u>×9</u>
5.	8293 <u>×9</u>	3768 <u>×9</u>	4685 <u>×9</u>	5739 <u>×9</u>	7093 <u>×9</u>

6. A grocer bought 279 lbs. of sugar at 9 cents a lb. How much did he pay for the sugar?

7. A farmer sold 9 cows at \$89 each. How much did he receive for the cows?

8. Two boys went walking for 19 days; each day they walked 9 miles. How far did they walk in the 19 days?

9. Find the cost of 9 pairs of skates at \$2.75 per pair.

To find one-ninth ($\frac{1}{9}$) of a number divide it by 9.

EXERCISE

Divide by 9 :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	4763	2839	5647	6835	4327
2.	72653	23258	36345	72653	20935
3.	24765	63583	22473	21358	47383
4.	21083	45783	85834	67673	25839
5.	47658	32109	83647	52634	76839

Find $\frac{1}{9}$ of each of the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
6.	48936	73892	21964	89643	91367
7.	58364	31895	68392	75648	56382

8. Nine girls in a Red Cross Club saved \$117. How much did each save?

9. A woman bought sugar at 9 cents a lb. and paid \$5.13. How many lbs. did she buy?

10. Jane bought 9 yards of silk and paid \$15.75. How much did she pay for the silk per yard?

11. Nine boys bought a tent for \$24.75 and divided the cost equally. How much did each pay?

TABLES OF 10's, 11's, AND 12's

Introductory.

Count by 10's to 50, 30, 90, 100, 70, 40, etc.

Count by 11's to 66, 99, 77, 22, 55, 88, etc.

Count by 12's to 48, 96, 72, 108, 132, 120, etc.

How many 10's are there in 70, 30, 60, 90, 120? etc.

How many 11's are there in 66, 44, 88, 55, 99? etc.

How many 12's are there in 72, 108, 120, 84? etc.

Review. 10 times 2, 4, 5, 6, 7, 9, 3, 8.

11 times 3, 5, 6, 2, 8, 9, 7, 4.

12 times 2, 5, 4, 6, 8, 7, 9, 3.

Learn:

10 times 10 are 100

11 times 10 are 110

10 times 11 are 110

12 times 10 are 120

10 times 12 are 120

11 times 11 are 121

11 times 12 are 132

12 times 11 are 132

12 times 12 are 144

ORAL DRILL

- | | | |
|------------------------|-------------|-----------------|
| 1. What are 10 eights? | 10 nines? | 10 sixes? |
| What are 11 sevens? | 11 twelves? | 11 fours? |
| What are 12 sixes? | 12 nines? | 12 sevens? etc. |

2. Give the answers :

10×6	10×7	10×8	10×9	12×12
11×7	11×12	11×9	11×3	11×6
12×5	12×8	12×7	12×4	12×9 etc.

3. Give the answers :

$11 \times 7 + 5$	$11 \times 8 + 9$	$12 \times 6 + 8$
$12 \times 9 + 4$	$12 \times 4 + 5$	$12 \times 5 + 4$
$10 \times 6 + 7$	$12 \times 6 + 9$	$11 \times 4 + 9$ etc.

4. How many 10's are there in 20, 50, 60? etc.
 How many 11's are there in 44, 88, 55? etc.
 How many 12's are there in 48, 96, 72, 60? etc.

5. How many 10's are there in 35, 83, 69? etc.
 How many 11's are there in 57, 69, 31? etc.
 How many 12's are there in 38, 54, 76? etc.

6. What does it cost to send a 12-word telegram at 7 cents for each word?

7. What is the cost of 8 grape-fruits at 10 cents each?

8. Oranges are worth 6 cents each. Find the price of 1 dozen.

9. Eleven girls brought 10 cents each to the Sunshine Fund. How much money did they bring altogether?

10. Mary earned 12 cents per day for 12 days. How much did she earn altogether?

Multiply :

a	b	c	d	e
1. 5476	2835	7293	6485	9834
$\times 10$	$\times 10$	$\times 10$	$\times 10$	$\times 10$

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
2.	3567 <u>×11</u>	4793 <u>×11</u>	3698 <u>×11</u>	5809 <u>×11</u>	2759 <u>×11</u>
3.	8947 <u>×11</u>	9608 <u>×11</u>	7089 <u>×11</u>	5983 <u>×11</u>	9867 <u>×11</u>
4.	3659 <u>×12</u>	6298 <u>×12</u>	4839 <u>×12</u>	5679 <u>×12</u>	9638 <u>×12</u>
5.	8293 <u>×12</u>	3768 <u>×12</u>	4685 <u>×12</u>	5739 <u>×12</u>	7093 <u>×12</u>

Divide :

	<i>a</i>	<i>b</i>	<i>c</i>
6.	89354 by 10	72384 by 10	568039 by 10
7.	26735 by 11	29835 by 11	37389 by 11
8.	56437 by 11	78658 by 11	84658 by 11
9.	26837 by 12	65839 by 12	72683 by 12
10.	76483 by 12	23256 by 12	82658 by 12

Find :

	<i>a</i>	<i>b</i>	<i>c</i>
11.	$\frac{1}{10}$ of 86475	$\frac{1}{11}$ of 83534	$\frac{1}{12}$ of 76583
12.	$\frac{1}{12}$ of 28365	$\frac{1}{10}$ of 39847	$\frac{1}{11}$ of 45038
13.	$\frac{1}{10}$ of 27969	$\frac{1}{11}$ of 87468	$\frac{1}{12}$ of 75834
14.	$\frac{1}{11}$ of 45839	$\frac{1}{12}$ of 72683	$\frac{1}{11}$ of 83209

PROBLEMS

1. There are 36 cabbage plants in each row. How many plants will be required for 12 rows?

2. How many sheep selling at \$12 each can be bought for \$540?

3. Milk is sold at 11 cents per quart. Find how much the milk for a family will cost in 1 month, if 87 quarts are used.

4. How many weeks are there in 294 days?

5. Mary is reading a book with 160 pages. If she reads 8 pages in one hour, how long will she take to read the book?

6. Marbles are sold at 8 for 10 cents. What is the price of 120 marbles?

7. A woman bought 3 dozen lemons at 5 cents each. What did she pay for the lemons?

8. There were 856 people in a church. One-fourth were children. How many children were there in the church?

9. A man has a journey of 342 miles to make. He has gone $\frac{1}{3}$ of it. How far has he gone?

10. A farmer had 448 sheep. He sold $\frac{1}{8}$ of his flock. How many sheep did he sell?

REVIEW EXERCISE

Write down from dictation, arrange in columns, and add :

$$1. 8463 + 298 + 5683 + 787 + 8963 + 5477.$$

$$2. 9568 + 75 + 3298 + 793 + 3298 + 29 + 8566.$$

$$3. 293 + 8367 + 6567 + 9583 + 376 + 2978 + 78.$$

$$4. 9583 + 49 + 2989 + 579 + 683 + 7832 + 76.$$

$$5. 839 + 7760 + 2105 + 3983 + 29 + 7653.$$

Write down from dictation, and subtract :

a	b
6. $8210 - 2958$	$6100 - 2987$

7. $9206 - 7587$	$2220 - 1937$
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8. $5100 - 4769$	$3225 - 1769$
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<i>a</i>	<i>b</i>
9. 8620—5937	4963—2278
10. 5120—4763	6580—2793

Write down from dictation, and multiply :

<i>a</i>	<i>b</i>
11. 6873 by 7	8497 by 9
12. 7285 by 6	3298 by 8
13. 2647 by 4	7839 by 5
14. 8395 by 7	9376 by 9
15. 6229 by 8	3269 by 7

Write down from dictation, and divide :

<i>a</i>	<i>b</i>
16. 2835 by 7	4325 by 8
17. 7384 by 5	3649 by 9
18. 2225 by 7	7634 by 4
19. 6210 by 9	5460 by 8
20. 3245 by 7	2622 by 5

Find .

<i>a</i>	<i>b</i>
21. $\frac{1}{8}$ of 6245	$\frac{1}{8}$ of 3242
22. $\frac{1}{7}$ of 2243	$\frac{1}{5}$ of 6234
23. $\frac{1}{9}$ of 9847	$\frac{1}{7}$ of 8345
24. $\frac{1}{4}$ of 8253	$\frac{1}{8}$ of 8876
25. $\frac{1}{9}$ of 72834	$\frac{1}{7}$ of 83210

ACCURACY AND TIME TESTS

Find how many of the following examples you can work
in 10 *minutes*; in 5 *minutes*:

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	6293	7293	8465	9847	9568
	478	989	767	283	5483
	2965	2659	39	3048	295
	823	729	8265	629	75
	4765	8395	568	4738	2969
	986	7886	2999	6567	829
	2438	5263	7608	295	8395
	<u>95</u>	<u>777</u>	<u>983</u>	<u>9859</u>	<u>695</u>
2.	9858	6475	8693	7788	5896
	658	937	809	2959	829
	3577	2648	5834	753	8395
	294	763	283	8347	777
	7658	9806	9439	953	8365
	29	83	564	3286	776
	385	297	4767	5783	6668
	<u>2989</u>	<u>6485</u>	<u>6083</u>	<u>839</u>	<u>576</u>
3.	2989	7683	4589	3678	5983
	976	809	3265	8563	2446
	7839	8323	598	473	738
	29	859	75	3269	9308
	587	6575	8239	7283	839
	6583	2395	789	658	4275
	777	898	3285	2663	596
	<u>9320</u>	<u>8459</u>	<u>764</u>	<u>296</u>	<u>3569</u>

Subtract :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
4.	84053 <u>29786</u>	53000 <u>26478</u>	29103 <u>15647</u>	83102 <u>56479</u>	62000 <u>38495</u>
5.	23012 <u>15839</u>	71002 <u>35687</u>	65000 <u>28579</u>	70000 <u>28396</u>	51000 <u>28326</u>

Multiply :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
6.	8473 by 7	9863 by 9	2698 by 8	7283 by 7
7.	6593 by 3	83093 by 4	9856 by 9	7839 by 8
8.	3279 by 5	26985 by 6	65839 by 7	8093 by 9
9.	45638 by 6	83097 by 7	64839 by 4	0983 by 8
10.	6387 by 7	2983 by 8	76849 by 9	4987 by 6

Divide :

	<i>a</i>	<i>b</i>	<i>c</i>
11.	86573 by 6	29683 by 8	41653 by 9
12.	82647 by 9	213985 by 5	64832 by 7
13.	24383 by 8	22645 by 8	23478 by 9
14.	23980 by 6	62346 by 7	41658 by 8
15.	92835 by 7	22328 by 9	62158 by 8

Find :

	<i>a</i>	<i>b</i>	<i>c</i>
16.	$\frac{1}{7}$ of 84763	$\frac{1}{8}$ of 86953	$\frac{1}{8}$ of 276035
17.	$\frac{1}{8}$ of 54839	$\frac{1}{7}$ of 28345	$\frac{1}{5}$ of 34835
18.	$\frac{1}{11}$ of 26478	$\frac{1}{6}$ of 47683	$\frac{1}{4}$ of 26478
19.	$\frac{1}{8}$ of 35647	$\frac{1}{9}$ of 72893	$\frac{1}{9}$ of 43506
20.	$\frac{1}{9}$ of 24358	$\frac{1}{12}$ of 23476	$\frac{1}{8}$ of 62583

CHAPTER IV

THE FOUR SIMPLE RULES AND APPLICATIONS

READING AND WRITING NUMBERS FROM 10,000 TO MILLIONS

Ten thousand is written 10,000.

Twenty thousand is written 20,000.

Thirty thousand is written 30,000.

Forty thousand is written 40,000.

Fifty thousand is written 50,000.

One hundred thousand is written 100,000.

Two hundred thousand is written 200,000.

Five hundred thousand is written 500,000.

Nine hundred thousand is written 900,000.

One million is written 1,000,000.

Fifty-six millions is written 56,000,000.

Read 653,247.

Beginning with the units, mark off to the left, periods of three figures. The first period of three figures is usually called the *units period*. It contains the units, tens, and hundreds figures. The second period is called the *thousands period*. In this period the figures are read in the ordinary way and are called thousands.

Example: Read 698,358.

Mark off the number into periods. The units period contains 358. The thousands period contains 698. Begin to read from the left.

Thus, six hundred ninety-eight *thousand*, three hundred fifty-eight,

Read 720,207.

Seven hundred twenty *thousand*, two hundred seven.

If a number contains more than six figures, there will be a third period after the thousands. This is called the *millions period*.

Read 7,283,567.

Seven million, two hundred eighty-three thousand, five hundred sixty-seven.

The following table illustrates the method of marking off numbers into periods:

Examples: 72,386,258 ; 234,708,530.

MILLIONS			THOUSANDS			UNITS		
Hundreds	Tens	Units	Hundreds	Tens	Units	Hundreds	Tens	Units
	7	2	3	8	6	2	5	8
2	3	4	7	0	8	5	3	0

EXERCISE

Draw a diagram similar to that given above and arrange the following numbers in their correct places.

<i>a</i>	<i>b</i>	<i>c</i>
1. 328,475	72,683	9,728,560
2. 79,500	236,475,600	500,003
3. 965,500	78,600,500	590,070,850

Read 238,457,685.

This number contains 3 periods. It is read thus:

Two hundred thirty-eight million, four hundred fifty-seven thousand, six hundred eighty-five.

EXERCISE

Read the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>
1.	827,395	460,832	296,723
2.	729,080	265,746	798,006
3.	520,008	760,800	295,630
4.	983,720	906,053	283,700
5.	726,835	700,800	600,002
6.	8,340,756	5,290,008	26,765,983
7.	26,730,820	52,685,200	75,830,295
8.	438,265,839	79,230,650	84,209,806
9.	671,728,386	230,560,728	7,265,832
10.	95,008,006	19,200,303	87,200,000

EXERCISE

Write from dictation :

	<i>a</i>	<i>b</i>	<i>c</i>
1.	365,847	295,363	728,456
2.	384,728	750,285	834,650
3.	983,720	830,534	225,400
4.	283,500	715,320	920,608
5.	635,002	283,750	408,002
6.	7,834,256	2,583,765	6,283,583
7.	2,583,496	7,835,959	5,732,694
8.	15,793,683	25,343,627	97,285,400
9.	56,204,630	38,400,003	26,700,350
10.	73,650,725	84,265,003	90,700,300

EXERCISE

Add :

1. 8277	2. 7281	3. 6987	4. 9752
6949	4969	6668	7831
9788	8799	7875	5527
9686	8698	8997	9886
6798	9769	4885	7734
5848	4858	9796	9958
7984	8979	8689	9475
<u>5878</u>	<u>7857</u>	<u>8799</u>	<u>6279</u>
5. 6677	6. 5966	7. 7238	8. 4922
1196	2787	4497	7857
6336	6896	9864	9637
9474	8567	8937	4762
4893	5674	4774	5446
8986	8963	3683	6697
8449	7878	9489	6857
<u>7723</u>	<u>9667</u>	<u>8119</u>	<u>9434</u>

Subtract :

1. 357,214	2. 653,243	3. 803,519
<u>193,526</u>	<u>274,857</u>	<u>724,163</u>
4. 521,734	5. 406,003	6. 836,700
<u>254,826</u>	<u>219,385</u>	<u>259,832</u>
7. 1,362,084	8. 2,048,173	9. 1,448,392
<u>973,295</u>	<u>839,194</u>	<u>795,093</u>

Multiply :

<i>a</i>	<i>b</i>	<i>c</i>
1. 86,573 by 4	298,376 by 6	39,584 by 8
2. 483,957 by 6	65,897 by 9	48,763 by 7
3. 987,653 by 7	208,953 by 3	56,837 by 5
4. 548,376 by 8	678,394 by 7	987,583 by 9

Divide :

<i>a</i>	<i>b</i>
1. 2,810,973 by 8	583,768 by 4
2. 4,286,135 by 6	234,783 by 8
3. 628,076 by 3	7,283,632 by 5
4. 958,347 by 7	2,121,253 by 9
5. 2,777,382 by 9	5,454,320 by 7

Learn :

There are 2 pints in 1 quart.
There are 4 quarts in 1 gallon.
There are 2 gallons in 1 peck.
There are 4 pecks in 1 bushel.

There are 12 inches in 1 foot.
There are 3 feet in 1 yard.
There are 36 inches in 1 yard.

There are 16 ounces in 1 pound.
There are 100 pounds in 1 hundredweight.

There are 60 minutes in 1 hour.
There are 24 hours in 1 day.
There are 7 days in 1 week.

ORAL EXERCISE

1. A milkman sold 84 pints of milk. How many quarts did he sell?

2. A grocer bought 15 gallons of maple syrup. How many quarts did he buy?

3. A farmer sold 25 bushels of potatoes. How many pecks did he sell?

4. A man feeds his horses 30 gallons of oats in a week. How many pecks does he feed?

5. Mary bought 18 feet of dress goods. How many yards did she buy?

6. A table-cloth is 72 inches long. What is its length in yards?

7. A woman bought $\frac{1}{4}$ of a pound of pepper. How many ounces did she buy?

8. A farmer sold a hog which weighed 225 lbs. How many hundredweight did the hog weigh?

9. A man worked 8 hours a day for 12 days. How many hours did he work?

10. I travel on a train from 8 A.M. until 2.30 P.M. How long am I on the train?

EXERCISE

1. A man had \$7500. He paid \$3950 for a house, \$675 for repairing the house, and \$454.50 for house furnishings. How much money had he left?

2. A man deposited in the bank \$125.75 a month for the first 7 months of the year and \$146.50 a month for the balance of the year. How much money did he deposit during the year?

3. A farmer received \$472.50 for 6 cows. What was the average price per cow?

4. One boy has \$3.60 in 10-cent pieces, and another boy has \$1.75 in 5-cent pieces. How many coins have the two boys together?

5. A man bought 8 bushels of potatoes at 75¢ per bushel and sold them at 25¢ per peck. How much did he make?

6. A boy rides his bicycle at an average speed of 7 miles per hour. How long will it take him to go a distance of 231 miles?

7. A lady bought a pair of gloves for \$1.75, handkerchiefs for 75¢, a pair of shoes for \$8.50, a skirt for \$7.65. She gave the clerk two ten-dollar bills. How much change did she receive?

8. A farmer's wife sold to a grocer 8 dozen eggs at 55¢ per dozen, 9 pounds of butter at 45¢ per pound, and 6 bushels of potatoes at 95¢ per bushel. How much does the grocer pay for this produce?

MULTIPLYING BY NUMBERS THAT EXCEED TWELVE

Introductory.

Multiply 9783 by 7.

$\begin{array}{r} 9783 \\ 7 \\ \hline 68,481 \end{array}$	<p>In this example the number 9783 is called the <i>multiplicand</i>, the number 7 the <i>multiplier</i>, and the number 68,481 the <i>product</i>.</p>
---	---

The *Multiplicand* is the number multiplied.

The *Multiplier* is the number by which we multiply.

The *Product* is the number resulting from the multiplication

Example: Multiply 479 by 57.

$$\begin{array}{r}
 479 \\
 \underline{57} \\
 \text{1st partial product} \quad 3,353 = 7 \text{ times the multiplicand.} \\
 \text{2nd partial product} \quad 23,950 = 50 \text{ times the multiplicand} \\
 \text{Entire product} \quad 27,303 = 57 \text{ times the multiplicand.}
 \end{array}$$

Since 57 is composed of 7 units and 5 tens or 50, 57 times the number must be equal to 7 times the number plus 50 times the number. 7 times 479 is 3353, the *first partial product*. We get 50 times 479 by first finding 10 times 479 and then multiplying this result by 5. 10 times 479 is 4790 and 5 times 4790 is 23,950, the *second partial product*. We write this under the first product, so that units come under units, tens under tens etc., and then we add the two partial products together.

$$\begin{array}{r}
 479 \\
 \underline{57} \\
 3353 \\
 2395 \\
 \hline
 27,303
 \end{array}$$

In actual practice we always omit the zero.

Example: Multiply 479 by 257.

$$\begin{array}{r}
 479 \\
 \underline{257} \\
 \text{1st partial product} \quad 3,353 = 7 \text{ times 479.} \\
 \text{2nd partial product} \quad 23,950 = 50 \text{ times 479.} \\
 \text{3rd partial product} \quad 95,800 = 200 \text{ times 479.} \\
 \text{Entire product} \quad 123,103 = 257 \text{ times 479.}
 \end{array}$$

In this example the multiplier is composed of 7 units, 5 tens or 50 and 2 hundreds or 200, so that 257 times the number will be 7 times the number, plus 50 times the number, plus 200 times the number.

$$\begin{array}{r}
 479 \\
 257 \\
 \hline
 3353 \\
 2395 \\
 958 \\
 \hline
 123,103
 \end{array}$$

In actual practice we omit the zeros.

Check. — Multiply the multiplier by the multiplicand. If the product is the same as before, the work is likely to be correct.

EXERCISE

Multiply :

- | | |
|-------------------|-------------------|
| 1. 744 by 65 | 17. 43,445 by 678 |
| 2. 895 by 87 | 18. 37,436 by 835 |
| 3. 972 by 96 | 19. 88,888 by 789 |
| 4. 825 by 58 | 20. 23,567 by 597 |
| 5. 973 by 79 | 21. 6484 by 965 |
| 6. 8462 by 86 | 22. 7856 by 758 |
| 7. 9643 by 95 | 23. 6748 by 697 |
| 8. 8532 by 69 | 24. 4878 by 834 |
| 9. 8984 by 48 | 25. 8547 by 586 |
| 10. 4659 by 89 | 26. 85,474 by 745 |
| 11. 28,352 by 64 | 27. 46,887 by 984 |
| 12. 41,678 by 85 | 28. 56,184 by 798 |
| 13. 34,073 by 63 | 29. 56,664 by 487 |
| 14. 40,735 by 628 | 30. 25,473 by 448 |
| 15. 29,304 by 789 | 31. 73,519 by 473 |
| 16. 90,705 by 897 | 32. 81,897 by 654 |

To multiply, when the multiplicand, the multiplier, or both, contain zeros.

Example: Multiply 2479 by 4006.

$$\begin{array}{r} 2479 \\ 4006 \\ \hline 14874 \\ 9916 \\ \hline 9,930,874 \end{array}$$

4006 times 2479 equals 4000 times 2479 plus 6 times 2479; 6 times 2479 is 14,874; 4000 times 2479 is 9,916,000. These partial products are written one under the other, the zeros being omitted.

EXERCISE

Multiply :

- | | |
|-----------------|--------------------|
| 1. 415 by 307 | 7. 9684 by 4008 |
| 2. 7004 by 902 | 8. 2002 by 4103 |
| 3. 2769 by 708 | 9. 3678 by 7068 |
| 4. 7364 by 5004 | 10. 9999 by 8008 |
| 5. 9006 by 7036 | 11. 3674 by 20,901 |
| 6. 8009 by 7008 | 12. 3798 by 40,809 |

Example: Multiply 614,000 by 700.

$$\begin{array}{r} 614,000 \\ 700 \\ \hline 429,800,000 \end{array}$$

This result is the same as that obtained by multiplying 614 by 7 and then annexing to the right *five* zeros, which is the sum of the number of zeros to the right of both the multiplicand, 614, and the multiplier, 7.

EXERCISE

Find the following products :

- | | |
|-----------------------|--------------------------|
| 1. 473×600 | 7. $18,000 \times 623$ |
| 2. 847×700 | 8. 6400×640 |
| 3. 9642×6300 | 9. 650×650 |
| 4. 1875×6340 | 10. $83,600 \times 7500$ |
| 5. 27×9000 | 11. 9230×7000 |
| 6. 6000×43 | 12. $8000 \times 61,000$ |

EXERCISE

1. If the cost of raising a crop of wheat is \$9.75 per acre, how much will it cost to raise the crop on 85 acres?
2. The oat crop in a 148-acre field averaged 67 bushels to the acre. Find the number of bushels this field yields.
3. What is the value of a carload of 48 steers at \$57.50 each?
4. A train travels at the rate of 38 miles per hour. What distance will it travel in 2 days?
5. A carpenter earns \$7.50 per day. How much will he earn in a month of 26 working days?
6. Coal sells for \$8.75 per ton. What will be the amount of my coal bill, if I burn 18 tons?
7. If 1 cow produces 379 pounds of milk per month, how many pounds will 38 cows produce in a month?

EXERCISE

1. In 1 ream of paper there are 480 sheets. How many sheets are there in 947 reams?
2. If a cotton mill manufactures 637 yards of cloth in one day, how many yards will it make in 307 days?
3. At \$125 each what will 49 horses cost?
4. A merchant bought 29 pieces of cloth; in each piece there were 57 yards. How many yards did he buy?
5. If 19,008 pounds of hay are required for the horses of a cavalry regiment for one day, how many pounds will be needed for 206 days?
6. What would be the cost of constructing 309 miles of macadam road at \$3975 per mile?
7. How many apples will an orchard containing 208 trees produce, if the average yield is 1269 apples for each tree?

8. How many yards of sheeting are there in 57 bales, each bale containing 25 pieces, and each piece 43 yards?

EXERCISE

1. How much will it cost to build 307 miles of railway at \$4060 per mile?

2. A contractor built 604 miles of railway at \$6500 a mile. How much did the building of the railway cost?

3. Find the cost of 486 acres of land at \$37 per acre.

4. If it requires 720 barrels of provisions to supply an army for one day, how many barrels will be required for 365 days?

5. If it costs \$9805 to build one mile of railway, how much will it cost to build 809 miles?

6. How many yards of cloth are there in 43 bales, each bale containing 72 pieces, and each piece 29 yards?

7. If a railway train goes 18 miles per hour, how far will it go in 17 days of 24 hours each?

8. A merchant had 26 pieces of cloth of 54 yards each, which he sold for 45 cents per yard. How much did he receive for the cloth?

DIVISION BY NUMBERS THAT EXCEED 12

Introductory.

Divide 86,573 by 9.

$$\begin{array}{r} 9,619 \quad 2 \text{ remainder} \\ 9 \overline{)86,573} \end{array}$$

In the example above, 86,573 is called the *dividend*, 9 is called the *divisor*, 9619 is called the *quotient*, and 2 is called the *remainder*.

The *dividend* is the number to be divided.

The *divisor* is the number by which the dividend is divided.

The *quotient* is the number of times the divisor is contained in the dividend.

The *remainder* is the number left over when the division is not exact.

LONG DIVISION

In the example given above, the work of division is done mentally. Where we have large numbers, it is necessary to write down all the steps, showing the work in dividing, multiplying, and subtracting.

Example: Divide 86,573 by 9.

$$\begin{array}{r}
 9619 \\
 9 \overline{)86573} \\
 \underline{81} \\
 55 \\
 \underline{54} \\
 17 \\
 \underline{9} \\
 83 \\
 \underline{81} \\
 2 \text{ remainder}
 \end{array}$$

Example: Divide 7681 by 43.

METHOD

EXPLANATION

$$\begin{array}{r}
 178 \\
 43 \overline{)7681} \\
 \underline{43} \\
 338 \\
 \underline{301} \\
 371 \\
 \underline{344} \\
 27
 \end{array}$$

76 hundreds divided by 43 is 1 hundred. Write 1 in the quotient above the hundreds. Then 43×1 hundred = 43 hundreds. Subtract 43 hundreds from 76 hundreds. Remainder is 33 hundreds. To 33 hundreds add 8 tens, making 338 tens. 338 tens divided by 43 are 7 tens. Write 7 tens in the quotient above the tens. Then 43×7 tens = 301 tens. Subtract 301 tens from 338 tens. Remainder is 37 tens. To 37 tens add 1 unit, making 371 units. 371 units divided by 43 are 8 units. Write 8 units in the quotient, above the units. Then 43×8 units are 344 units. Subtract 344 units from 371 units. Remainder is 27 units.

NOTE TO THE TEACHER. — The teacher should develop the brief form of long division shown on the left. The pupils should not be required to learn or to write down the detailed explanation of the method.

Example: Divide 100,221 by 37.

$$\begin{array}{r}
 2708 \\
 37 \overline{)100221} \\
 \underline{74} \\
 262 \\
 \underline{259} \\
 321 \\
 \underline{296} \\
 25 \text{ Remainder}
 \end{array}$$

Note. — The remainder after each partial division must be less than the divisor.

Example: Divide 8476 by 53.

$ \begin{array}{r} 159 \\ 53 \overline{)8476} \\ \underline{53} \\ 317 \\ \underline{265} \\ 526 \\ \underline{477} \\ 49 \text{ Remainder} \end{array} $	<p><i>Check</i></p> <table style="border: none; margin-left: 20px;"> <tr> <td style="text-align: right;">159</td> <td>Quotient</td> </tr> <tr> <td style="text-align: right;"><u>53</u></td> <td>Divisor</td> </tr> <tr> <td style="text-align: right;">477</td> <td></td> </tr> <tr> <td style="text-align: right;"><u>795</u></td> <td></td> </tr> <tr> <td style="text-align: right;">8427</td> <td></td> </tr> <tr> <td style="text-align: right;"><u>49</u></td> <td>Remainder</td> </tr> <tr> <td style="text-align: right;">8476</td> <td>Dividend</td> </tr> </table>	159	Quotient	<u>53</u>	Divisor	477		<u>795</u>		8427		<u>49</u>	Remainder	8476	Dividend
159	Quotient														
<u>53</u>	Divisor														
477															
<u>795</u>															
8427															
<u>49</u>	Remainder														
8476	Dividend														

Note. — To check the accuracy of division, multiply the quotient by the divisor and add the remainder to the product. The result should be the dividend.

Check for Multiplication.

Example: Multiply 7832 by 356.

	<i>Check</i>
7832	7832
356	356)2788192
<u>46992</u>	<u>2492</u>
39160	<u>2961</u>
23496	<u>2848</u>
2788192	<u>1139</u>
	<u>1068</u>
	712
	712

EXERCISE

Divide the following, and check your answers :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. 1323 by 21	2564 by 31	1876 by 41	21,283 by 51
2. 2193 by 41	3952 by 31	58,563 by 61	30,783 by 62
3. 8475 by 32	7293 by 52	6897 by 62	7248 by 32
4. 9465 by 43	7386 by 44	9473 by 24	6984 by 33
5. 86,156 by 71	74,383 by 54	26,378 by 82	43,657 by 64

<i>a</i>	<i>b</i>	<i>c</i>
6. 18,749 by 63	28,465 by 72	46,035 by 85
7. 27,231 by 24	31,406 by 34	86,664 by 74
8. 29,364 by 62	83,735 by 72	46,792 by 83
9. 86,473 by 64	64,371 by 65	56,932 by 94
10. 89,576 by 27	78,391 by 53	96,243 by 73

EXERCISE

Divide the following, and check your answers :

<i>a</i>	<i>b</i>	<i>c</i>
1. 46,827 by 27	87,468 by 64	97,648 by 63
2. 13,853 by 45	8,642,396 by 35	66,842 by 93

<i>a</i>	<i>b</i>	<i>c</i>
3. 87,648 by 81	419,421 by 97	80,647 by 86
4. 81,761 by 59	60,803 by 92	86,647 by 78
5. 29,583 by 37	26,278 by 29	65,843 by 39
6. 173,843 by 86	223,475 by 69	262,837 by 58
7. 638,473 by 87	262,973 by 96	209,835 by 57
8. 203,473 by 38	546,803 by 87	268,347 by 49
9. 219,583 by 92	627,834 by 86	472,658 by 75
10. 346,583 by 49	206,583 by 53	728,935 by 89

EXERCISE

Divide the following, and check your answers :

<i>a</i>	<i>b</i>
1. 583,475 by 121	236,469 by 153
2. 648,532 by 163	4,836,583 by 172
3. 2,029,653 by 142	629,584 by 192
4. 3,269,583 by 123	728,564 by 165
5. 2,647,835 by 184	609,324 by 156
6. 428,356 by 223	7,269,483 by 189
7. 624,783 by 241	538,473 by 323
8. 29,658,647 by 234	628,584 by 351
9. 826,573 by 543	293,847 by 449
10. 726,584 by 349	728,364 by 279

EXERCISE

Divide the following, and check your answers :

<i>a</i>	<i>b</i>
1. 628,357 by 378	265,867 by 259
2. 426,583 by 229	7,863,842 by 531
3. 3,973,053 by 726	2,264,783 by 437
4. 296,476 by 229	8,364,753 by 279

<i>a</i>	<i>b</i>
5. 6,473,832 by 435	264,658 by 634
6. 206,473 by 237	628,658 by 373
7. 465,983 by 449	6,475,836 by 729
8. 2,020,937 by 516	3,627,875 by 479
9. 6,278,394 by 239	3,265,862 by 457
10. 2,164,783 by 339	6,078,364 by 347

EXERCISE

1. A farmer sold his cattle at \$51 per head. He received \$72,012.00. How many cattle did he sell?

2. The government built 471 miles of gravel road at a cost of \$2,325,798. What was the average cost per mile?

3. The C. P. R. built 287 miles of railway at a cost of \$5,236,602. What was the average cost per mile?

4. The Western Manufacturing Company employs 250 men. The wages paid for 1 year were \$337,500. What was the average yearly wage?

5. A produce dealer bought turkeys at \$3.75 each. If he paid \$9101.25, how many turkeys did he buy?

6. A farmer sold a load of wheat at \$1.85 per bushel and received for the load \$231.50. How many bushels were there in the load?

7. A man travelled by motor car at the rate of 27 miles per hour. He had a journey of 2160 miles to make and travelled 10 hours per day. How many days did it take to make the journey?

8. Sound travels 37,060 feet in 34 seconds. How far will it travel in 1 second?

9. I bought a farm of 160 acres for \$12,000. What price did I pay per acre?

10. A farmer had 248 acres in wheat from which he raised 8928 bushels. Find the average yield per acre.

EXERCISE

1. A carpenter earns \$145 a month ; his expenses are at the rate of \$88 per month. He wishes to purchase a lot of ground, which contains 19 acres and is valued at \$42 per acre. How long will it take him to save enough to buy the land?

2. A farmer bought a farm from A at \$60 per acre and a farm of the same size from B at \$85 per acre. The total cost was \$53,215. How many acres did he buy from each?

3. A merchant sold a piece of cloth containing 45 yards, and another containing 63 yards, at \$3.75 per yard. What did he receive for both pieces of cloth?

4. A man left \$2535 to each of his four children. On the death of one of them, the three remaining children divided the money equally among themselves. How much did each receive?

5. A man earns \$25 a week and spends \$12 per week. He saved \$195. How many weeks did he work?

6. A farmer has 24 cows and 93 sheep valued at \$2988. If the sheep are valued at \$12 each, what is the value of each cow?

7. How many barrels of flour at \$6 per barrel are equal in value to 1100 tons of coal at \$9 per ton?

8. If a mechanic earns \$165 per month, and his expenses are \$69 per month, how long will it take him to pay for a market garden of 16 acres valued at \$72 an acre?

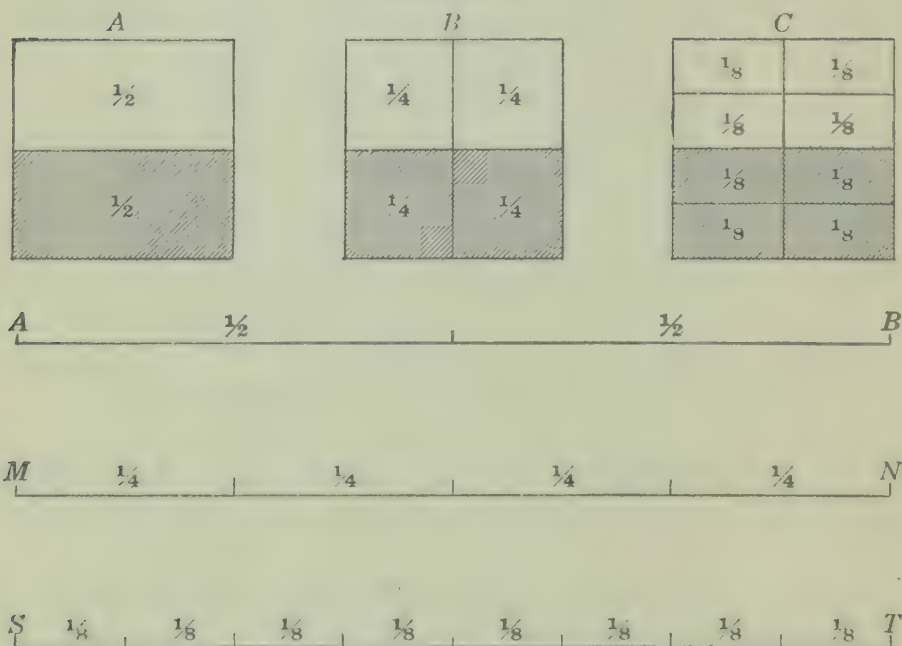
EXERCISE

1. What will 15 slates cost, if 5 slates cost 80 cents?

2. If 4 books cost 72 cents, what will 3 books cost?

3. If 6 barrels of flour cost \$48, what will 7 barrels cost ?
4. If 4 cords of wood cost \$24, what will be the cost of 16 cords of wood ?
5. If 15 yards of cloth cost \$75, what will 20 yards cost ?
6. If 7 pounds of beef cost \$1.75, what will 5 pounds cost ?
7. If 12 men can earn \$84 in a day, how much can 4 men earn in the same time ?

FRACTIONS



Into how many equal parts is the square A divided ?
 Into how many equal parts is the square B divided ?
 Into how many equal parts is the square C divided ?
 What part of square A is each of the two equal parts ?
 What part of square B is each of the four equal parts ?
 What part of the square C is each of the eight equal parts ?

One or more of the equal parts into which a unit is divided is called a *fraction*.

A square, a line, a circle, 1 dollar, 1 inch, 1 are called units.

When the square A is divided into two equal parts, each part is also a unit, but a smaller unit than the whole square of which each is a part. Each of these equal units is a fractional part of the large unit, the whole square; each unit is one-half of it. These units are called *fractional units*.

A fractional unit is one of the equal parts into which a unit is divided.

What is the fractional unit of each part in square B? In square C?

The fractional unit in square A is one-half, written $\frac{1}{2}$.

The fractional unit in square B is one-fourth, written $\frac{1}{4}$.

The fractional unit in square C is one-eighth, written $\frac{1}{8}$.

Three of the fractional units in square B are represented by the fraction $\frac{3}{4}$. Five of the fractional units in square C are represented by the fraction $\frac{5}{8}$.

A fraction consists of one or more fractional units, as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{2}{3}$, $\frac{4}{5}$, etc.

The number below the line shows the number of equal parts or fractional units into which the whole is divided.

The number above the line shows how many of the equal parts or fractional units are taken.

Write the fractions representing one of the equal parts of the line AB; two of the equal parts of the line MN; three of the equal parts of the line MN; four of the equal parts of the line ST; seven of the equal parts of the line ST.

Divide a line into 5 equal parts. What is the fractional unit of each part? Write the fraction that represents 2 of these parts; 3 of these parts; 4 of these parts; 5 of these parts.

In square B how many fourths are shaded? The shaded part is what part of the whole square? One-half is equal to how many fourths?

In square C how many eighths are shaded? How many fourths are shaded? What part of the whole square is the shaded part?

One-half is equal to how many eighths?

Two-fourths are equal to how many eighths?

$$\frac{1}{2} = \frac{4}{8}$$

$$\frac{2}{4} = \frac{4}{8}$$

$$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$$

EXERCISE

1. $\frac{1}{4}$ is what part of $\frac{1}{2}$? $\frac{1}{8}$ is what part of $\frac{1}{4}$? $\frac{1}{8}$ is what part of $\frac{1}{2}$?

2. $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$; $\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$; $\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$; $\frac{2}{4} - \frac{1}{4} = \frac{1}{4}$.

3. $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$; $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{3}{8}$; $\frac{3}{8} + \frac{1}{8} = \frac{4}{8}$; $\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$.

4. $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$; $\frac{1}{2} + \frac{3}{4} = \frac{5}{4}$; $\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$; $\frac{1}{4} + \frac{5}{8} = \frac{7}{8}$.

5. $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$; $\frac{1}{2} + \frac{3}{8} = \frac{7}{8}$; $\frac{1}{2} + \frac{5}{8} = \frac{9}{8}$.

6. $\frac{1}{2} - \frac{1}{8} = \frac{3}{8}$; $\frac{1}{4} - \frac{1}{8} = \frac{1}{8}$; $\frac{1}{2} - \frac{3}{8} = \frac{1}{8}$; $\frac{3}{4} - \frac{5}{8} = \frac{1}{8}$; $\frac{3}{4} - \frac{1}{2} = \frac{1}{4}$;
 $\frac{7}{8} - \frac{1}{4} = \frac{5}{8}$; $\frac{6}{8} - \frac{1}{2} = \frac{1}{4}$.

7. How many halves are in 2? in $2\frac{1}{2}$? in 3? in $6\frac{1}{2}$?

8. How many fourths are in 2? in 3? in 4? in $3\frac{1}{4}$? in $3\frac{1}{2}$?

9. How many eighths are in 2? in 4? in 5? in $2\frac{1}{8}$? in $3\frac{1}{4}$? in $2\frac{1}{2}$?

Examples:

Add: $1\frac{1}{4}$ Add the fractional numbers; $\frac{1}{4}$ and $\frac{2}{4} = \frac{3}{4}$. Add the
 $3\frac{2}{4}$ whole numbers; 1 and 3 = 4. Sum = $4\frac{3}{4}$.
 $4\frac{3}{4}$

Add: $2\frac{1}{4}$ $\frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1$. Carry the 1 to the column of whole
 $3\frac{3}{4}$ numbers. $1 + 3 + 2 = 6$.
 6

Add: $4\frac{2}{4}$ $\frac{2}{4} + \frac{3}{4} = \frac{5}{4} = 1 + \frac{1}{4}$. Put down $\frac{1}{4}$ and carry the whole
 $\begin{array}{r} 5\frac{3}{4} \\ 10\frac{1}{4} \end{array}$ number 1 to the column of whole numbers. The sum of
whole numbers is $1+5+4=10$.

Subtract: $5\frac{3}{4}$
 $\begin{array}{r} 4\frac{2}{4} \\ 1\frac{1}{4} \end{array}$ $\frac{3}{4} - \frac{2}{4} = \frac{1}{4}$.
 $5 - 4 = 1$.

Subtract: 6
 $\begin{array}{r} 2\frac{3}{4} \\ 3\frac{1}{4} \end{array}$ $6 = 5 + \frac{4}{4}$ or $5\frac{4}{4}$
 $5\frac{4}{4} - 2\frac{3}{4} = 3\frac{1}{4}$.

EXERCISE

1. Add:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
$1\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{3}{4}$	$3\frac{2}{4}$	$5\frac{1}{8}$	$3\frac{7}{8}$	$4\frac{5}{8}$	$2\frac{7}{8}$
$2\frac{1}{2}$	$3\frac{2}{4}$	$2\frac{1}{4}$	$5\frac{3}{4}$	$4\frac{3}{8}$	$2\frac{1}{8}$	$5\frac{3}{8}$	$6\frac{2}{8}$

2. Subtract:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
$6\frac{1}{2}$	$7\frac{3}{4}$	$3\frac{5}{8}$	$5\frac{7}{8}$	$4\frac{8}{8}$	$5\frac{3}{4}$
$3\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{8}$	$2\frac{5}{8}$	$3\frac{1}{8}$	3

3. Subtract:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
7	4	7	8	6	9
$4\frac{6}{8}$	$2\frac{1}{4}$	$5\frac{1}{2}$	$4\frac{1}{6}$	$3\frac{3}{4}$	$7\frac{5}{6}$

NOTE TO THE TEACHER. — By means of circles, squares, lines, etc. teach the relation of: *thirds* and *sixths*; *thirds* and *ninths*; *fifths* and *tenths*; *halves* and *sixths*; *halves* and *tenths*.

Show that $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$.

EXERCISE

1. $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$; $\frac{1}{3} + \frac{2}{3} = \frac{3}{3}$; $\frac{3}{3} - \frac{1}{3} = \frac{2}{3}$; $\frac{3}{3} - \frac{2}{3} = \frac{1}{3}$.

2. $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6}$; $\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$; $\frac{2}{6} + \frac{3}{6} = \frac{5}{6}$; $\frac{4}{6} - \frac{1}{6} = \frac{3}{6}$; $\frac{5}{6} - \frac{4}{6} = \frac{1}{6}$.

$$3. \quad \frac{1}{3} + \frac{1}{6} = \frac{?}{6}; \quad \frac{2}{3} + \frac{1}{6} = \frac{?}{6}; \quad \frac{1}{3} + \frac{2}{6} = \frac{?}{6}; \quad \frac{1}{3} + \frac{4}{6} = \frac{?}{6}.$$

$$4. \quad \frac{1}{3} - \frac{1}{6} = \frac{?}{6}; \quad \frac{2}{3} - \frac{1}{6} = \frac{?}{6}; \quad \frac{2}{3} - \frac{4}{6} = \frac{?}{6}; \quad \frac{3}{3} - \frac{5}{6} = \frac{?}{6}.$$

$$5. \quad \frac{1}{3} + \frac{1}{9} = \frac{?}{9}; \quad \frac{2}{3} + \frac{1}{9} = \frac{?}{9}; \quad \frac{1}{3} + \frac{4}{9} = \frac{?}{9}; \quad \frac{1}{3} - \frac{1}{9} = \frac{?}{9}; \quad \frac{2}{3} - \frac{4}{9} = \frac{?}{9};$$

$$\frac{3}{3} - \frac{6}{9} = \frac{?}{9}.$$

$$6. \quad \frac{1}{5} + \frac{1}{10} = \frac{?}{10}; \quad \frac{1}{5} + \frac{3}{10} = \frac{?}{10}; \quad \frac{3}{5} + \frac{4}{10} = \frac{?}{10}; \quad \frac{1}{5} - \frac{1}{10} = \frac{?}{10};$$

$$\frac{3}{5} - \frac{5}{10} = \frac{?}{10}; \quad \frac{4}{5} - \frac{6}{10} = \frac{?}{10}.$$

$$7. \quad \frac{1}{2} + \frac{1}{6} = \frac{?}{6}; \quad \frac{1}{2} + \frac{4}{6} = \frac{?}{6}; \quad \frac{1}{2} - \frac{1}{6} = \frac{?}{6}; \quad \frac{1}{2} - \frac{2}{6} = \frac{?}{6}.$$

$$8. \quad \frac{1}{2} + \frac{1}{10} = \frac{?}{10}; \quad \frac{1}{2} + \frac{3}{10} = \frac{?}{10}; \quad \frac{1}{2} - \frac{3}{10} = \frac{?}{10}; \quad \frac{1}{2} - \frac{4}{10} = \frac{?}{10}.$$

EXERCISE

1. Add:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
$4\frac{1}{3}$	$5\frac{2}{3}$	$3\frac{1}{6}$	$7\frac{2}{6}$	$8\frac{2}{5}$	$9\frac{4}{5}$	$5\frac{4}{9}$	$2\frac{5}{9}$	$4\frac{3}{10}$	$5\frac{7}{10}$
$5\frac{2}{3}$	$6\frac{2}{3}$	$5\frac{4}{6}$	$8\frac{5}{6}$	$5\frac{3}{5}$	$6\frac{3}{5}$	$8\frac{2}{9}$	$8\frac{7}{9}$	$7\frac{6}{10}$	$9\frac{4}{10}$

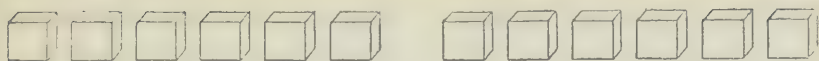
2. Subtract:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
$7\frac{5}{6}$	$8\frac{4}{9}$	$6\frac{7}{10}$	$5\frac{1}{2}$	$7\frac{1}{2}$	$9\frac{1}{6}$	$6\frac{1}{9}$	$8\frac{3}{10}$	$7\frac{1}{6}$	$9\frac{3}{10}$
$3\frac{2}{3}$	$5\frac{1}{3}$	$2\frac{3}{5}$	$2\frac{1}{6}$	$3\frac{3}{10}$	$4\frac{2}{3}$	$2\frac{1}{3}$	$4\frac{4}{5}$	$4\frac{1}{2}$	$6\frac{1}{2}$

Draw a line 8 inches long and divide it into two equal parts. What part of the whole line is each part? How many inches are there in each part? How do you find $\frac{1}{2}$ of 8 inches?

Divide the line into 4 equal parts. What part of the whole line is each part? How many inches are there in each part? How do you find $\frac{1}{4}$ of 8 inches? How many inches are there in $\frac{2}{4}$ of the line?

Divide a line 12 inches long into three equal parts. What part of the whole line is each part? How many inches are there in each part? How do you find $\frac{1}{3}$ of 12 inches? How would you find $\frac{1}{6}$ of 12 inches? How many inches are there in $\frac{2}{3}$ of this line? in $\frac{1}{6}$ of this line? in $\frac{5}{6}$ of this line?



Divide 12 blocks into two groups, each group having an equal number of blocks. How many blocks are there in each group? Each group contains $\frac{1}{2}$ of all the blocks. $\frac{1}{2}$ of 12 blocks = 6 blocks.

$$\frac{1}{2} \text{ of } 12 = 6.$$



Divide 12 blocks into six groups, each group having an equal number of blocks. Each group is what part of all the groups? The number in each group will be what part of the whole number of blocks? How many blocks are there in each group?

$$\frac{1}{6} \text{ of } 12 \text{ blocks} = 2 \text{ blocks}$$

$$\frac{1}{6} \text{ of } 12 = 2.$$

How many blocks are there in 2 groups? Two groups are $\frac{2}{6}$ of all the blocks.

$$\frac{2}{6} \text{ of } 12 \text{ blocks} = 4 \text{ blocks}$$

$$\frac{2}{6} \text{ of } 12 = 4.$$

$$\frac{3}{6} \text{ of } 12 = ?$$

$$\frac{4}{6} \text{ of } 12 = ?$$

$$\frac{5}{6} \text{ of } 12 = ?$$

Examples:

To find $\frac{5}{6}$ of 24. $\frac{1}{6}$ of 24 = 4, then $\frac{5}{6}$ of 24 = 5 times 4 = 20.

To find $\frac{7}{8}$ of 40. $\frac{1}{8}$ of 40 = 5, then $\frac{7}{8}$ of 40 = 7 times 5 = 35.

EXERCISE

- | | | | |
|---------------------------------|----------------------|----------------------|----------------------|
| 1. What is $\frac{1}{4}$ of 12? | $\frac{3}{4}$ of 20? | $\frac{1}{8}$ of 16? | $\frac{5}{8}$ of 16? |
| $\frac{1}{3}$ of 21? | $\frac{2}{3}$ of 15? | $\frac{1}{5}$ of 15? | $\frac{4}{5}$ of 15? |
| $\frac{1}{9}$ of 27? | $\frac{7}{9}$ of 27? | $\frac{5}{7}$ of 21? | $\frac{8}{9}$ of 81? |
| $\frac{5}{8}$ of 72? | $\frac{6}{7}$ of 49? | $\frac{4}{5}$ of 60? | $\frac{7}{9}$ of 54? |
| $\frac{3}{8}$ of 88? | $\frac{5}{6}$ of 54? | | |

2. 4 is what part of 16? 8 is what part of 24? 6 is what part of 24? 5 is what part of 30? 7 is what part of 42? 3 is what part of 21? 7 is what part of 21? 9 is what part of 45? 9 is what part of 81? 8 is what part of 72? 2 is what part of 18?

3. If I cut $\frac{1}{2}$ yard of tape from a piece $\frac{3}{4}$ yard long, how much is left?

4. A board is $3\frac{2}{3}$ feet long. What length of board will be left, if I saw off a piece $1\frac{1}{3}$ feet long?

5. A boy works $2\frac{1}{3}$ hours on Monday and $3\frac{5}{6}$ hours on Tuesday. How many hours did he work on both days?

6. A window is $5\frac{3}{4}$ feet high and $3\frac{1}{2}$ feet wide. How much greater is the height than the width?

7. There are $\frac{7}{8}$ of a yard of cloth in one piece and $\frac{3}{8}$ of a yard in another piece. What is the length of the cloth in the two pieces?

8. Helen bought 6 yards of ribbon and used $1\frac{3}{4}$ yards for a hair ribbon. How much ribbon has she left?

9. I spent $\$1\frac{1}{2}$ for groceries and $\$ \frac{3}{4}$ for meat. How much money did I spend altogether?

10. If 8 yards of cloth cost \$24, what part of \$24 will one yard cost?

11. Find the cost of each of the following:

$3\frac{1}{2}$ pounds of steak at 30¢ per pound.

$4\frac{1}{3}$ dozen eggs at 45¢ per dozen.

$6\frac{1}{4}$ pounds of cheese at 32¢ per pound.

$2\frac{3}{4}$ yards of cloth at 80¢ per yard.

$5\frac{2}{3}$ dozen oranges at 60¢ per dozen.

12. There are $5\frac{1}{2}$ yards in 1 rod. How many yards are there in 20 rods?

13. What part of a foot is 4 inches? 3 inches? 9 inches? 8 inches?

14. Express as pounds, 20 ounces; 24 ounces; 28 ounces.

15. What part of a yard is 9 inches? 27 inches? 24 inches?

16. How many hours longer is $\frac{1}{2}$ of a day than $\frac{1}{3}$ of a day?

17. If butter is sold at 40¢ per pound, what will 5 pounds 4 ounces cost?

18. Find the number of ounces in $\frac{3}{4}$ pound, in $\frac{7}{8}$ pound, in $\frac{5}{16}$ pound.

19. What part of a pound is 2 ounces? 4 ounces? 12 ounces? 8 ounces?

20. If you buy $1\frac{5}{8}$ dozen eggs at 48¢ per dozen, how much change should you receive from a dollar bill?

CHAPTER V

PROBLEM WORK AND ACCURACY TESTS

ORAL EXERCISE

1. A lady gave a half dollar and three 10-cent pieces for 2 yards of muslin. What was the price per yard?
2. A boy is reading a book of 100 pages. He has read 60 pages. How long will it take him to finish the book, if he reads 10 pages an hour? : 4 / 5
3. If 3 pounds of sugar cost 30 cents, what will 7 pounds cost?
4. How many cars are there in two passenger trains, one having 18 cars and the other 15 cars?
5. Bacon sells for 60 cents per pound. What part of a pound can I buy with 20 cents?
6. A man is 34 years old. In how many years will he be 50 years old?
7. How many days are there in 6 weeks? How many hours are there in $1\frac{1}{2}$ days? How many minutes are there in $2\frac{1}{2}$ hours?
8. A motor car travels at the rate of 20 miles per hour. How long will it take to travel a distance of 70 miles?
9. How many times can 15 cents be subtracted from 75 cents?
10. A family uses 3 quarts of milk per day. How many quarts did they use in the month of June?

ORAL EXERCISE

1. I paid \$56 for coal at \$8 per ton. How many tons did I buy?
2. Oranges are selling at 3 for 10 cents. How many can I buy for half a dollar?
3. A milliner trims 8 hats at a cost of \$5 each and sells them at \$9 each. How much does she make?
4. In an arithmetic exercise there were 21 problems. James solved $\frac{1}{3}$ of them. How many did he solve?
5. A merchant bought suits at \$30 each and sold them at \$42 each. How much did he make on the sale of 5 suits?
6. At 49 cents each, how many hockey sticks can be bought for \$5? How much change will there be?
7. How many quarts of milk does a 15-gallon can contain?
8. If a boy saves 10 cents a day during the month of December, how much less than \$4 does he save?
9. If 6 pounds of sugar cost 72 cents, how many pounds can be bought for 60 cents?
10. A baker burns 20 tons of coal every 3 months. What will his coal cost for a year at \$5 per ton?

PROBLEMS WITHOUT NUMBERS

1. If you know the cost of one thing, how can you find the cost of a given number of things?
2. If you know the cost of a given number of things, how can you find the price of one thing?
3. If you know the total selling price of two things and the selling price of one of them, how can you find the selling price of the other?
4. If a division is exact, the dividend is the product of what two numbers?

5. If you know the cost of a quart of anything, how can you find the cost of a gallon? of a pint?

6. How do you find the number of minutes in a day? The number of hours in a week?

7. If a certain number of articles cost a given sum, how can you find how much three times as many articles cost?

8. If you know the cost price of an article and the price for which it was sold, how can you find the gain?

9. If you know the cost price of an article and the gain made in selling the article, how can you find the selling price?

10. If you know the selling price of an article and the gain, how can you find the cost price?

11. If you buy a given number of sheep at a certain price per sheep and sell them at a greater price per sheep, in what two ways can you find the total gain?

12. How do you find three-fourths of any number?

Making Change

Find the amount of change in each of the following :

<i>Articles purchased</i>	<i>Amount paid</i>
1. $1\frac{1}{2}$ yards lace at 30¢ per yard	\$1
2. 1 knife, 55 cents	\$1
3. 8 yards of print at 25¢ per yard	\$2
4. 3 dozen eggs at 45¢ per dozen	
2 pounds bacon at 65¢ per pound	
12 pounds sugar at 15¢ per pound	\$5

	<i>Articles purchased</i>	<i>Amount paid</i>
5.	2 pair shoes at \$6.75 per pair $\frac{1}{2}$ dozen handkerchiefs at \$3 per dozen 3 collars at 25¢ each 5 pairs stockings at 75¢ per pair	\$20
6.	2 brooms at 75¢ each 7 bars soap at 5¢ per bar 9 pounds rice at 12¢ per pound 6 pounds tea at 65¢ per pound 8 pounds coffee at 55¢ per pound	\$15
7.	1 suit of clothes @ \$58.75 1 overcoat @ \$32.50	\$100
8.	$\frac{1}{2}$ dozen kitchen chairs @ \$1.75 each . .	\$15
9.	2 pounds steak @ 35¢ per pound Leg of mutton, 6 pounds, @ 48¢ per pound 6 pounds cured ham @ 60¢ per pound . .	\$10

EXERCISE

- From the sum of \$3.50 and \$4.75 take the difference between \$8.20 and \$6.50.
- Find the total cost of the following bills of goods :
 - 1 dozen handkerchiefs @ 25¢ each.
 2 dozen towels @ 30¢ each.
 30 napkins @ 75¢ each.
 9 yards of silk @ \$2.75 per yard.
 15 yards cotton @ 25¢ per yard.
 - 1 case of eggs (30 dozen) @ 45¢ per dozen.
 15 pounds of tea @ 70¢ per pound.
 6 baskets of grapes @ 85¢ per basket.
 2 quarts of maple syrup @ \$2.00 per gallon.
 $\frac{1}{2}$ dozen canned fruit @ 45¢ per can.

3. A farmer brought to a store \$3.75 worth of eggs and \$7.45 worth of butter. How many pounds of sugar at 10¢ per pound did he receive in exchange?

4. A farmer sold some oats for \$450, wheat for \$970, and barley for \$580. How many acres of land at \$25 per acre could he buy with this money?

5. A mill owner sold his mill that cost him \$13,200 at a loss of \$1650, and with the money bought land at \$30 per acre. How many acres did he buy?

6. At 5¢ per pint what will 6 quarts of milk cost?

7. How many gallons of molasses selling at 10¢ per quart can you buy for \$1.20?

8. At \$16 per ton, how many tons of hay can you buy with \$720?

9. A farmer lost \$750 on a farm which he sold for \$5870. How much would he have received for the farm, if in selling it he had gained \$380?

10. A man paid \$85 for a carriage and three times as much for a driving horse. How much money did the horse and carriage together cost?

EXERCISE

1. In a village school the attendance was, Monday 138, Tuesday 145, Wednesday 136, Thursday 143, Friday 146. Find the total attendance for the week.

2. Which is worth the more, and how much more, a farm of 640 acres valued at \$25 per acre or 35 building lots valued at \$450 each?

3. A tailor has a piece of cloth containing 145 yards. How many yards will be left after cutting from it 24 suits, if each suit requires 5 yards?

4. A clerk receives \$65 per month for the first four months of the year, \$75 per month for the next four months, and \$85 per month for the remainder of the year. How much money does he earn in a year?

5. A farmer had a flock of 120 sheep. He sold $\frac{1}{4}$ of them for \$450. How many did he sell? How much did he receive for each sheep?

6. A city newspaper has 19,275 subscribers, 3486 of whom live outside the city. How many live in the city?

7. A dairy company buys 300 quarts of milk daily from the farmers. How many gallons of milk does the company buy in a week?

8. A man bought a house for \$3675 and sold it for \$4250.

X How much did he gain?

9. A merchant pays \$1260 a year for the rent of his store, \$1600 to one clerk, \$1275 to another, \$1540 to his bookkeeper, and \$687 for other expenses. What are the expenses of his business for one year?

10. If 2 acres of wheat produce 70 bushels, what will 12 acres produce at the same rate of yield?

EXERCISE

1. A young man earns \$105 per month and spends \$48 per month. How much will he save in 2 years?

2. A rancher has 328 horses. He keeps 150 of them and sells the remainder at \$125 per head. How much does he receive for them?

3. There are 69 eggs in a box. How many will be left after 4 dozen of them are sold?

4. A man bought a sofa for \$73 and two chairs at \$22.50 each. He gave the clerk 12 ten-dollar bills. How much change did he receive?

5. A carload of lemons consisting of 2950 boxes was sold at \$2.35 per box. Find the value of the carload.

6. Find the cost of sending 28,500 pounds of oranges from California to Edmonton at \$1.15 per 100 pounds.

7. A farmer bought a house and lot in the city for \$6000. As part payment he gave 124 steers valued at \$45 each, and the balance he paid in cash. How much cash did he pay?

8. In 1 ream of paper there are 480 sheets. How many sheets are there in 947 reams?

9. How many apples will an orchard containing 387 trees produce, if the average yield is 1269 apples for each tree?

10. How many yards of sheeting are there in 389 bales, if each bale contains 25 pieces and each piece 43 yards?

EXERCISE

1. A sheep buyer bought 247 sheep at \$15.75 each and 123 more at \$14.50 each. How much did he pay for all the sheep?

2. A grocer mixed 78 pounds of tea costing 45 cents per pound, 65 pounds costing 42 cents per pound, and 39 pounds costing 55 cents per pound. What did the mixture cost him? If he sold this mixture at 60 cents per pound, how much did he gain?

3. A merchant had 26 pieces of cloth of 54 yards each, which he sold at 45 cents per yard. How much did he receive for the cloth?

4. A flour mill grinds 125 barrels of 196 pounds each per day. How many pounds will this mill grind in 2 weeks of 6 days each?

5. How much will it cost to build 628 miles of railroad at \$7500 per mile?

6. A farmer sold 58 cows at \$74 each and received in payment \$3750 cash and a second-hand motor car. What did the motor car cost him?

7. A farmer sold 76 hens at 95 cents each, 23 ducks at \$1.15 each, and 48 turkeys at \$4.25 each. How much money did he receive for his fowl?

8. If a dairy cow eats 35 pounds of silage per day, how many pounds of silage will it take to feed a herd of 24 cows for 30 days?

9. A man receives a salary of \$2500 per year. He pays \$35 per month house rent, \$55 per month for food and clothing, and \$260 per year for other expenses. How much money does he save each year?

10. I bought 8 pounds of sugar at 15 cents per pound, 4 dozen eggs at 55 cents per dozen, 5 pounds of tea at 65 cents per pound, and 2 dozen oranges at 60 cents per dozen. What was the amount of my bill?

EXERCISE

1. A man bought 320 acres of land at \$25 per acre. He paid \$5500 cash. How much does he still owe?

2. How many inches are in 278 yards?

3. A farmer sold a load of wheat containing 21 bags of 2 bushels each at \$1.95 per bushel. How much did he get for the load?

4. A grain buyer bought 2850 bushels of oats at 68 cents per bushel and sold them at 75 cents per bushel. How much money did he make?

5. How much will 20 men earn in two weeks, if each earns \$4.25 per day?

6. A farmer bought a motor car costing \$1875. In payment for the car he gave 12 young horses valued at \$95 each, and the balance in money. How much money did he pay?

7. A merchant went to the bank to get small change. How many 10-cent pieces did he get for three 2-dollar bills? How many 5 cent pieces did he get for two 5-dollar bills?

8. If it costs 25 cents for the first 10 words of a telegram and 3 cents for each additional word, what is the cost of a telegram of 18 words?

9. A boy has a paper route with 48 customers. The paper sells at 15 cents per week. At the end of the week the boy collected \$5.10. How much is still owing him on his week's sales?

10. John received two 10-dollar bills for a Christmas present. He bought a pair of boots costing \$4.75, a pair of skates costing \$2.15, 3 pairs of stockings at 75 cents per pair, and 4 shirts at \$1.35 each. How much money had he left?

EXERCISE

1. A gallon of maple syrup costs \$2.00. At the same price what will a pint cost?

2. How many days are there in 1032 hours?

3. A farmer using two binders can cut 25 acres of wheat per day. How long will it take to cut his crop of 650 acres?

4. A cattle buyer bought 24 head of steers for \$1080. What was the average price per head?

5. A traveller stopped at a hotel 8 days and was charged \$28.00. What rate per day did the hotel charge?

6. How many years are in 6708 weeks?

7. A barrel of flour weighs 196 pounds. How many barrels will it take to hold 406,700 pounds of flour?
8. There were 156 bananas in a bunch. How many dozen bananas were there?
9. How many yards are in 3888 inches?
10. How many pounds of beef at 30 cents per pound can be bought for \$5.40?

EXERCISE

1. A train travels 840 miles in a day. How many miles per hour does it travel?
2. If a horse eats 2 quarts of oats in a day, how long will 3 pecks last him?
3. A lady bought 6 chairs and a table for \$120. If the table cost \$48, what was the price of each chair?
4. A family's milk supply for a week cost \$2.10. How many quarts per day did they use, if the price of a quart was 15 cents?
5. Find the total earnings of a laborer who has worked 504 hours at \$3.50 per day of 8 hours each.
6. At a sheep sale 48 sheep were sold for \$672. Find the average sale price per sheep.
7. A man earns \$123.50 per month. How much does he earn per day, if he works 26 days per month?
8. A man with \$3008 bought as many horses as possible at \$145 each and invested the remainder in sheep at \$12 each. How many horses and how many sheep did he buy?
9. A clerk's salary is \$95 per month, and his expenses are \$39 per month. How long will it take him to save \$504?
10. A canning factory ships 45,000 cans of fruit in boxes which hold 3 dozen cans. How many boxes will be required?

Accuracy and Time Tests

Count 5 marks for each correct answer and find how many marks you can make in 5 minutes ; in 10 minutes.

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	98,636	32,908	98,756	7,938	83,948
	41,684	6,783	4,689	856	76,495
	74,849	91,876	987	69,594	94,783
	85,872	65,394	95	8,457	58,798
	98,637	9,548	75,823	96,783	68,869
	<u>29,468</u>	<u>83,679</u>	<u>9,438</u>	<u>9,658</u>	<u>89,557</u>
	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
	\$435.50	\$968.38	\$897.78	\$396.85	\$78.49
	296.85	257.45	676.93	8.74	596.27
	927.44	98.47	784.67	85.97	923.85
	633.29	9.63	687.89	963.45	49.68
	379.86	.85	836.78	858.56	486.99
	543.75	795.98	458.65	7.63	6.75
	<u>897.55</u>	<u>627.67</u>	<u>239.48</u>	<u>85.46</u>	<u>35.85</u>

2. Add :

$$(a) 6472 + 8733 + 4639 + 8454 + 9658 + 8963$$

$$(b) 721 + 6434 + 8705 + 97 + 896 + 8 + 573 + 2563$$

$$(c) 15 + 8756 + 7805 + 66,782 + 4987 + 8768$$

$$(d) 1525 + 920 + 96 + 837 + 6874 + 79 + 9$$

$$(e) 7 + 89 + 897 + 9284 + 576 + 87 + 37 + 658$$

$$(f) \$3127.24 + \$918.30 + \$309.43 + \$9.48 + \$100.49$$

$$(g) \$976.45 + \$8.75 + \$856.09 + \$77.43 + \$6.84 + \$768.94$$

$$(h) \$1002.80 + \$15.65 + \$763.97 + \$5.88 + \$97.38 + \$928.54$$

3. Dictate the following numbers for the pupils to add :

$$(a) 405, 9367, 8029, 7008, 25,039, 88, 768, 1001, 101.$$

$$(b) 98, 827, 5099, 8888, 6003, 8, 596, 76, 2002.$$

(c) 7805, 66,782, 4987, 65, 605, 20,098, 5609, 8008.

(d) \$37.95, \$906.88, \$3856.45, \$2008.68, \$9.08, \$686.

Add :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
4.	6472	2762	1617	2650	7583	27,845
	8733	8756	8743	4062	3847	67,832
	4633	9783	7284	8705	785	74,281
	4854	4578	9621	9030	8764	68,432
	569	432	978	999	5938	3,687
	<u>8674</u>	<u>9876</u>	<u>8465</u>	<u>2897</u>	<u>898</u>	<u>9,699</u>

	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
	6,758	958	89	45,849	8976
	4,367	5,863	8,756	89,763	2145
	47,823	127	983	48,297	6389
	68,421	6,434	65,782	93,826	8547
	79,893	7,895	9	58,643	9872
	50,387	66,786	17	86,578	5988
	5,648	4,987	874	78,947	4365
	<u>79</u>	<u>8,768</u>	<u>78</u>	<u>25,644</u>	<u>7898</u>

5. Multiply :

- | | |
|--------------------|---------------------|
| (a) 8396 by 98 | (i) 203,806 by 9008 |
| (b) 9439 by 76 | (j) 695,836 by 96 |
| (c) 7385 by 96 | (k) 74,382 by 3052 |
| (d) 6804 by 79 | (l) 89,675 by 745 |
| (e) 59,403 by 258 | (m) \$28.75 by 68 |
| (f) 68,946 by 374 | (n) \$67.56 by 95 |
| (g) 469,382 by 708 | (o) \$909.74 by 325 |
| (h) 87,143 by 687 | (p) \$2080.55 by 49 |

6. Subtract :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
3,946,275	2,095,643	8,605,037	7,032,050
<u>2,897,328</u>	<u>1,987,296</u>	<u>5,986,395</u>	<u>6,984,736</u>

<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
\$4362.95	\$3000.25	\$5306.09	\$10,083.55
<u>2976.28</u>	<u>1964.37</u>	<u>4968.27</u>	<u>9,998.68</u>

7. Subtract :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
\$258.25	\$598.27	\$306.00	\$827.55	\$428.62
<u>199.48</u>	<u>399.48</u>	<u>229.43</u>	<u>538.68</u>	<u>247.83</u>

<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
\$1790.73	\$335.50	\$2396.00	\$5008.23	\$6029.45
<u>895.87</u>	<u>38.65</u>	<u>1847.38</u>	<u>4959.38</u>	<u>4976.86</u>

<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>
\$302.25	\$805.07	\$1000.00	\$500.10	\$1032.55
<u>9.88</u>	<u>88.88</u>	<u>638.27</u>	<u>7.88</u>	<u>897.68</u>

8. Multiply :

(a) 744 by 635	(i) 23,567 by 597
(b) 895 by 637	(j) 88,888 by 789
(c) 972 by 843	(k) 85,474 by 5093
(d) 5946 by 76	(l) 3798 by 6070
(e) 8972 by 97	(m) 89,638 by 5004
(f) 4963 by 86	(n) 3678 by 7068
(g) 34,073 by 758	(o) 8964 by 20,903
(h) 29,304 by 879	(p) 73,519 by 4735

9. Divide :

(a) 87,468 by 64	(i) 876,905 by 379
(b) 13,853 by 45	(j) 293,854 by 467
(c) 730,821 by 49	(k) 395,603 by 683
(d) 419,421 by 99	(l) 200,356 by 758

(e) 80,634 by 144

(f) 39,298 by 801

(g) 80,157 by 346

(h) 600,805 by 196

(m) \$796.92 by 229

(n) \$696.87 by 267

(o) 407,886 by 471

(p) 311,812 by 548

10. (a) Add :

479 763

867 825

358 394

946 958

783 276

695 587

877 493

532 639

649 865

286 478

(b) Subtract :

8,603,102 42,100,683

5,978,467 39,472,895

(c) Multiply :

53,798 by 79

6473 by 368

(d) Divide :

376,548 by 97

8,529,406 by 386

11. (a) Add :

298 786

637 825

579 377

846 593

647 289

786 438

535 746

982 674

247 859

685 495

(b) Subtract :

3,405,002 7,130,642

1,985,726 6,291,733

(c) Multiply :

67,834 by 89

8596 by 746

(d) Divide :

241,367 by 68

4,302,583 by 579

CHAPTER VI

FACTORS, MEASURES, TESTS OF DIVISIBILITY, CANCELLATION, MULTIPLES

I. Factors

Definition:

When two or more numbers are multiplied together, they make a *product*. The numbers which make up the product are called *factors*.

$$4 \times 3 = 12.$$

4 and 3 are factors of 12.

$$2 \times 3 \times 5 = 30.$$

2 and 3 and 5 are factors of 30.

The multiplicand and multiplier are factors of the product. *Factoring* is the process of breaking up a number or a product into its factors.

Thus

$$27 = 3 \times 9.$$

$$105 = 3 \times 5 \times 7.$$

A *Prime Factor* or a *Prime Number* is a number that is not exactly divisible by any whole number except 1 and itself.

Thus 1, 2, 3, 5, 7, 11, 13, etc. are prime numbers.

ORAL EXERCISE

1. Give 2 factors of: 15, 35, 36, 77, 63, and 21.
2. Give 3 factors of: 12, 30, 66, 20, 42, and 56.

3. If 3 is one factor, what is the other factor of 21, 45, 36, 24, 18, and 33?

4. If 12 is one factor, what is the other factor of 60, 48, 72, 96, 24, and 108?

EXERCISE

Find the second factor in each of the following :

	<i>Factor</i>	<i>Product</i>	<i>Other Factor</i>
1.	9	63	
2.	7	105	
3.	11	132	
4.	17	153	
5.	23	161	
6.	29	145	
7.	13	520	
8.	31	341	
9.	37	333	
10.	43	559	

ORAL EXERCISE

Give the prime factors of the following: 15, 18, 35, 28, 42, 56.

To find the prime factors of a large number, for example, 156.

$$\begin{array}{r|l}
 2 & 156 \\
 2 & 78 \\
 3 & 39 \\
 13 & 13 \\
 & 1
 \end{array}$$

Divide first by 2, a prime number; then again by 2; then by 3, another prime number. Continue the division by prime numbers.

The prime factors are $2 \times 2 \times 3 \times 13$.

Rule:—To find the prime factors of any number, divide the number by prime factors and continue this division until the final quotient is a prime number.

EXERCISE

Find the prime factors of the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	28	32	33	48
2.	65	66	72	96
3.	35	36	39	147
4.	49	52	54	108
5.	77	78	81	144
6.	84	88	91	186
7.	165	336	392	297
8.	189	195	396	715
9.	170	105	396	1463
10.	168	576	315	1365

Definition :

If a number is a factor of *two or more* numbers, it is called a *Common Factor* of these numbers.

2 is a common factor of 4 and 14.

7 is a common factor of 21 and 35.

EXERCISE

Find the common factors of each of the following pairs of numbers :

- | | |
|--------------|---------------|
| 1. 16 and 24 | 4. 39 and 52 |
| 2. 36 and 42 | 5. 84 and 210 |
| 3. 21 and 56 | 6. 78 and 195 |

The largest factor that is a common factor of two or more numbers is called the *Highest Common Factor* or *H. C. F.* of the numbers.

Thus 9 is the H. C. F. of 27 and 36.

To find the Highest Common Factor of two or more numbers.

Find the prime factors of the given numbers. The product of the prime factors that are common to all the numbers is the Highest Common Factor of the numbers.

Find the Highest Common Factor of 48, 72, and 96.

$$48 = 2 \times 2 \times 2 \times 2 \times 3$$

$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

$$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$$

The factors common to 48, 72, and 96 are $2 \times 2 \times 2 \times 3$.

The product of these factors, 24, is the Highest Common Factor.

EXERCISE

Find the Highest Common Factor of the following :

- | | | | | | | |
|-------|----|----|-------|-----|-----|-------------------|
| 1. 16 | 20 | 24 | 5. 81 | 108 | 162 | 9. 309 and 315 |
| 2. 26 | 78 | 52 | 6. 42 | 63 | 147 | 10. 1908 and 2736 |
| 3. 19 | 76 | 95 | 7. 56 | 96 | 128 | |
| 4. 36 | 54 | 72 | 8. 45 | 75 | 90 | |

II. Measures

1. Find the common factors of 248 and 356. Ascertain whether each common factor of 248 and 356 is also a factor of 108, their difference.

2. Write two numbers having a common factor. Find their sum and their difference, and discover whether the common factor of the two numbers is a factor of their sum and also of their difference.

3. Write two numbers having a common factor. Take any multiple of one of them, and find whether the common factor of the two numbers is a factor of the difference between this multiple and the other number.

It will thus be seen that a common factor of two numbers is also a factor of the sum or the difference of these numbers, and is also a factor of the difference between a multiple of one of them and the other.

To find the Highest Common Factor when the numbers are large:

Example: Find the H. C. F. of 52 and 91.

52)91(1
 $\begin{array}{r} 52 \\ \hline 39 \end{array}$ 52(1
 $\begin{array}{r} 39 \\ \hline 13 \end{array}$ 39(3
 $\begin{array}{r} 39 \\ \hline 0 \end{array}$

13 is a divisor of 39 and, therefore, of 13 plus 39, or 52. Since it divides 39 and 52, it also divides 39 plus 52, or 91; 13 is, therefore, a divisor or factor of 52 and 91. It is also the Greatest Common Factor. If not, let a greater number divide 52 and 91; it will then divide 39, their difference, and, dividing 39 and 52, it will also divide their difference, or 13. That is, a greater number than 13 will divide 13, which is impossible. 13 is therefore the Greatest Common Divisor, or H. C. F., of 52 and 91.

Hence to find the H. C. F. of two numbers:

(1) Divide the greater number by the less.

(2) Divide the less by the remainder.

(3) Divide the first remainder by the second and continue this process, always dividing the last divisor by the last remainder. The last remainder which divides the preceding divisor exactly is the *Greatest Common Divisor*, or *Highest Common Factor*.

EXERCISE

Find the H. C. F. of:

- | | |
|------------------|---------------------|
| 1. 115 and 161 | 7. 6006 and 3318 |
| 2. 333 and 592 | 8. 2871 and 4213 |
| 3. 697 and 820 | 9. 43902 and 49593 |
| 4. 392 and 672 | 10. 23940 and 28350 |
| 5. 405 and 900 | 11. 32480 and 44544 |
| 6. 1220 and 2013 | 12. 18577 and 40012 |

To find the H. C. F. of more than two numbers.

First find the H. C. F. of two of them. Then find the H. C. F. of the common factor thus found and a third number, and so on through all the numbers. The last common factor found will be the H. C. F. of all the numbers.

EXERCISE

Find the H. C. F. of :

- | | |
|--------------------------|-----------------------|
| 1. 1435 ; 1064 ; 2135 | 3. 4795 ; 3395 ; 6048 |
| 2. 14385 ; 20391 ; 49287 | 4. 5463 ; 6677 ; 7891 |

III. Tests of Divisibility

There are some easy tests of divisibility of certain numbers that should be known. These are as follows :

1. A number is exactly divisible by 2, if it ends in 0 or in an even number.
2. A number is exactly divisible by 4, if the number represented by the two right-hand digits is exactly divisible by 4, or if the last two digits are zeros.
3. A number is exactly divisible by 5, if it ends in 5 or 0.
4. A number is exactly divisible by 3, if the sum of its digits is exactly divisible by 3.
5. A number is exactly divisible by 9, if the sum of its digits is exactly divisible by 9.
6. A number is exactly divisible by 8, if the number represented by the three right-hand digits is exactly divisible by 8, or if the last three digits are zeros.
7. A number is exactly divisible by 6, if it is an even number and if the sum of its digits is exactly divisible by 3.

IV. Cancellation

Simplify 12×18 divided by 4×6 .

$(12 \times 18) \div (4 \times 6)$ is the same as

$$\begin{array}{r} 1 \\ 2 \quad 9 \\ \hline 12 \times 18 \\ 4 \times 6 \\ \hline 2 \quad 1 \\ 1 \end{array} = 9$$

Explanation.

Select common factors from dividend and divisor.

6 is a common factor of 12 and 6

2 is a common factor of 18 and 4

2 is a common factor of 2 and 2

The quotient is the product of the remaining factors of the dividend divided by the product of the remaining factors of the divisor, after the cancellation of all common factors.

EXERCISE

1. Simplify each of the following :

$$\frac{9 \times 7}{3 \times 7} = \quad , \quad \frac{7 \times 5 \times 120}{7 \times 4 \times 30} = \quad , \quad \frac{15 \times 20 \times 25}{30 \times 50} = \quad .$$

2. Simplify $(25 \times 36 \times 11) \div (55 \times 4)$.

3. Simplify $(24 \times 27 \times 32) \div (36 \times 48)$.

4. Find the value of: $\frac{18 \times 22 \times 35 \times 42}{49 \times 33 \times 15}$.

5. Divide the product of 20, 35, and 60 by the product of 14, 15, and 25.

6. A farmer exchanged 8 barrels of apples for 240 lbs. of sugar at 12 cts. per pound. Find the selling price of the apples.

7. If 128 dozen eggs pay for 56 yards of cloth at 96 cents per yard, what is the price of the eggs per dozen?

8. If 240 sheep are exchanged for 25 horses at \$144.00 each, what is each sheep worth?

9. A man worked 8 days and received in payment 24 bushels of potatoes selling at 96 cents per bushel. How much did he earn each day?

10. How many tubs of butter weighing 54 lbs. each, selling at 42 cents per pound, will pay for 378 yards of cloth which sells at 30 cents per yard?

11. At what price per dozen must 260 dozen eggs be sold to pay for 78 yards of silk at 95 cents per yard?

12. Divide the product of 8, 15, 24, 42, 65, and 77 by the product of all the prime numbers less than 15.

13. If a farmer raises 1050 bushels of wheat on a 30-acre field, how many bushels should he raise at the same rate from 96 acres?

V. Multiples

Definition:

Instead of saying that one number may be divided by another number exactly, we sometimes say that the first number is a *Multiple* of the second number.

For example: 18 is a multiple of 3, 6, and 9.

ORAL EXERCISE

1. Give 3 multiples of each of the following numbers: 5, 7, 8, 9, and $2\frac{1}{2}$.

2. What are the following numbers multiples of: 35, 48, 27, 63, 56?

3. Give all the multiples of 2 of the numbers from 4 to 40 inclusive.

4. Give all the multiples of 3 of the numbers from 6 to 57 inclusive.

5. 38 is a multiple of what *two* factors?

Definition:

When a number is exactly divisible by two or more numbers it is said to be a *Common Multiple* of these numbers.

For example: 42 is a common multiple of 6 and 7.

105 is a common multiple of 3, 5, and 7.

Definition:

The smallest number that is exactly divisible by two or more numbers is called the *Least Common Multiple* (L. C. M.) of those numbers.

For example: 105 is the L. C. M. of 21 and 35.

ORAL EXERCISE

1. Give *four* numbers that contain both 2 and 7 as factors.
2. Give *four* numbers that contain both 3 and 5 as factors.
3. Give the *Least Common Multiple* of each of the following pairs of numbers:

4 and 7

6 and 9

5 and 11

7 and 8

9 and 12

3 and 7

To Find the Least Common Multiple of Two or More Numbers

Example: To find the L. C. M. of 56, 60, 84, and 112.

Factor each of the numbers.

$$56 = 2 \times 2 \times 2 \times 7$$

$$60 = 2 \times 2 \times 3 \times 5$$

$$84 = 2 \times 2 \times 7 \times 3$$

$$112 = 2 \times 2 \times 2 \times 2 \times 7$$

The Least Common Multiple of these numbers must be a number which will contain all the prime factors of each of the numbers.

2 will be a factor of the L. C. M. repeated *four* times, since 112 contains 2 as a factor repeated *four* times.

3 will be a factor of the L. C. M. *once*, since 60 and 84 contain 3 as a factor *once*.

5 will be a factor of the L. C. M. *once*, since 60 contains 5 as a factor *once*.

7 will be a factor of the L. C. M. *once*, since 56, 84, and 112 each contains 7 as a factor *once*.

The L. C. M. is $2 \times 2 \times 2 \times 2 \times 3 \times 5 \times 7$, or 1680.

The work of factoring may be put down in shortened form.

2	56.	60.	84.	112
2	28.	30.	42.	56
2	14.	15.	21.	28
3	7.	15.	21.	14
7	7.	5.	7.	14
	1.	5.	1.	2

Divide by prime factors beginning with the lowest. Continue the division so long as there are common factors.

L. C. M. is $2 \times 2 \times 2 \times 2 \times 3 \times 5 \times 7$.

EXERCISE

- Find the L. C. M. of 12, 15, 20, and 18.
- Find the L. C. M. of 5, 15, 7, and 35.
- Find the L. C. M. of 36, 72, 60, and 84.
- Find the L. C. M. of 11, 7, 21, 28, and 66.
- Find the L. C. M. of \$2.00, \$3.00, \$4.00, \$5.00, \$20.00, and \$50.00.

REVIEW EXERCISE

1. Find the H. C. F. and the L. C. M. of 32 and 80.
2. Find the H. C. F. and the L. C. M. of 42 and 49.

Find the H. C. F. and the L. C. M. of the following sets of numbers :

- | | |
|---------------|----------------------|
| 3. 64 and 224 | 6. 12, 15, and 54 |
| 4. 68 and 187 | 7. 24, 36, and 204 |
| 5. 21 and 231 | 8. {18, 54, and 144} |

Find the prime factors of the following numbers :

- | | | |
|----------|----------|------------|
| 9. 2730 | 11. 6270 | 13. 3828 |
| 10. 7140 | 12. 7245 | 14. 14,091 |

Find the Least Common Multiple of the following sets of numbers :

- | | |
|---------------------|---------------------|
| 15. 16, 80, and 960 | 17. 16, 96, and 108 |
|---------------------|---------------------|

- | | |
|-------------------------|-------------------------|
| X (16. 18, 66, and 242 | X 18. 21, 63, and 399) |
|-------------------------|-------------------------|

19. A room is twice as long as it is wide and contains 288 square feet of flooring. Find the dimensions of the room.

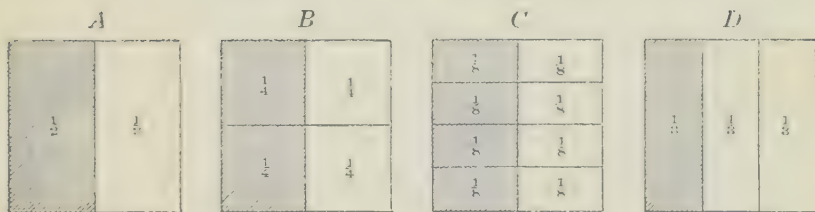
20. Divide \$60.00 between two boys, so that the first boy will receive half as much again as the second.

21. How many times is the H. C. F. of 32, 72, and 192 contained in their L. C. M.?

CHAPTER VII

FRACTIONS

Common or Vulgar Fractions



ORAL EXERCISE

When anything is divided into 2 equal parts, what is each part called?

What is each part called when anything is divided into 4 equal parts? into 8 equal parts? into 3 equal parts? into 6 equal parts? into 5 equal parts?

We write these parts as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{5}$.

In Figure B we see that if we divide $\frac{1}{2}$ into 2 equal parts we get $\frac{1}{4}$.

That is, $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$
 $\frac{1}{2} + \frac{1}{2} = ?$

In Figure C we divided $\frac{1}{2}$ into 4 equal parts, and each part is $\frac{1}{8}$.

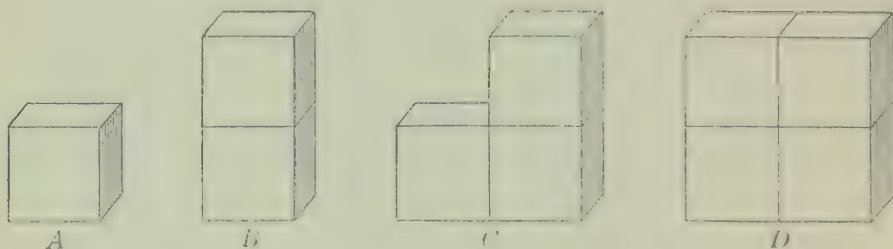
That is, $\frac{1}{4}$ of $\frac{1}{2} = \frac{1}{8}$
 $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = ?$

In Figure C each $\frac{1}{4}$ is divided into 2 equal parts, and each part is $\frac{1}{8}$.

That is,

$$\frac{1}{2} \text{ of } \frac{1}{4} = \frac{1}{8}$$

$$\frac{1}{8} + \frac{1}{8} = \frac{1}{4}$$



Consider the Figures A, B, C, and D.

A is what part of B? of C? of D?

B is what part of C? of D?

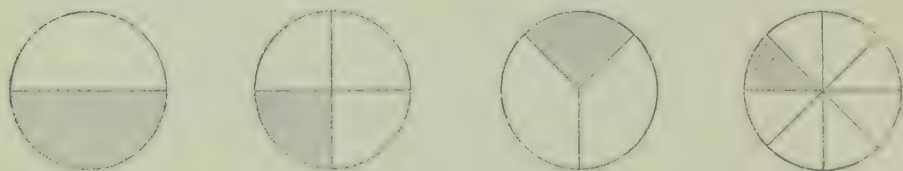
C is what part of D?

If we call D 1, then we shall call A 1 quarter, B 2 quarters, and C 3 quarters.

If we call A 1, then we shall call B 2, C 3, and D 4.

If B is called 1, what shall we call A? C? D?

If C is called 1, what shall we call A? B? D?



If we divide a circle into two equal parts, what do we call each part?

If we divide a circle into 4 equal parts, each part is called $\frac{1}{4}$.

How many quarters are there in the whole circle?

If we take three of these equal parts, we have 3 quarters of the circle.

This is written $\frac{3}{4}$.

If we take 2 of these equal parts, we have 2 quarters.

This is written $\frac{2}{4}$.

If we divide a circle into 3 equal parts and take 2 of them, how much of the circle have we?

This is written $\frac{2}{3}$.

If we divide a circle into 8 equal parts and take 3 of them, 4 of them, 5 of them, 7 of them, 6 of them, 2 of them, what part of the circle have we in each case?

These are written : $\frac{3}{8}$ $\frac{4}{8}$ $\frac{5}{8}$ $\frac{7}{8}$ $\frac{6}{8}$ $\frac{2}{8}$.



To find a fraction of a number of units.

We have six cubes. Let us divide these into two equal groups. There are three in each group. The group 6 has been divided into 2 equal groups. Each of the smaller groups is *one-half* the larger group. Then $\frac{1}{2}$ of 6 is 3.

Similarly if we had 10 objects and divided these into 5 groups with the same number in each group, each of the smaller groups would contain 2 objects. Each of the smaller groups is *one-fifth* the larger group.

$\frac{1}{5}$ of 10 is 2. $\frac{2}{5}$ of 10 is 4. $\frac{3}{5}$ of 10 is 6.

EXERCISE

1. What is $\frac{1}{2}$ of 12? $\frac{1}{3}$ of 15? $\frac{1}{3}$ of 18? $\frac{1}{4}$ of 20?
 $\frac{1}{5}$ of 18? $\frac{1}{11}$ of 33? $\frac{1}{9}$ of 27?

2. What is $\frac{2}{3}$ of 12? $\frac{3}{5}$ of 15? $\frac{3}{4}$ of 16? $\frac{4}{5}$ of 25?
 $\frac{5}{8}$ of 36? $\frac{4}{9}$ of 54? $\frac{5}{12}$ of 60?

3. One unit = $\frac{?}{2} = \frac{?}{3} = \frac{?}{4} = \frac{?}{6} = \frac{?}{7} = \frac{?}{9} = \frac{?}{12} = \frac{?}{15} = \frac{?}{25} = \frac{?}{75}$.

4. Show by drawings or by cutting a square of paper the following: $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \frac{6}{12} = \frac{8}{16}$.

5. $\frac{1}{5} = \frac{?}{10} = \frac{?}{15} = \frac{?}{20} = \frac{?}{25}$.

6. $\frac{4}{5} = \frac{?}{10} = \frac{?}{15} = \frac{?}{20} = \frac{?}{25} = \frac{?}{30}$.

7. Arrange in order of magnitude beginning with the largest fraction: $\frac{1}{3}, \frac{1}{5}, \frac{1}{2}, \frac{1}{7}, \frac{1}{8}, \frac{1}{4}, \frac{1}{9}, \frac{1}{15}$.

8. Arrange in order of magnitude, beginning with the smallest fraction: $\frac{3}{4}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{5}, \frac{6}{7}, \frac{9}{10}, \frac{7}{8}, \frac{8}{9}$.

Draw a line 5 inches long.

What part of 1 foot is this line?

Draw a line 7 inches long.

What part of 1 foot is this line?

The line 5 inches long is what part of the line 7 inches long?

A man has to make a journey of 12 miles. He has gone 4 miles. What part of his journey has he completed?

What part of his journey has he yet to go?

A boy earned \$15 in one month. He spent \$9 of this. What part of his earnings did he spend?

What part of his earnings did he save?

3 ounces is what part of 1 lb.?

10 is what part of 1 dozen?

27 inches is what part of 1 yard?

3 days is what part of 1 week?

25 minutes is what part of 1 hour?

A *unit* is one thing considered as an undivided whole.

A *fraction* is one or more of the equal parts into which a unit has been divided, as : $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{6}$, $\frac{7}{8}$, $\frac{1}{9}$, etc.

The *denominator* of a fraction shows the number of equal parts into which the unit has been divided. It is written below the line in writing fractions. 8, 6, 5, 4 are the denominators of $\frac{3}{8}$, $\frac{2}{6}$, $\frac{1}{5}$, $\frac{3}{4}$.

The *numerator* of a fraction shows how many of the equal parts have been taken to make the fraction. The numerator is written above the line. In the fractions, $\frac{5}{8}$, $\frac{4}{7}$, $\frac{1}{5}$, $\frac{7}{9}$, 5, 4, 1, and 7 are the numerators.

The *numerator* and *denominator* are called the *terms* of the fractions.

A *proper fraction* is one whose numerator is smaller than its denominator, as : $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{16}$.

A *unit fraction* is a fraction having 1 as numerator.

An *improper fraction* is one whose numerator is equal to or greater than its denominator, as : $\frac{5}{3}$, $\frac{7}{4}$, $\frac{12}{9}$.

A *mixed number* is the sum of a whole number and a fraction expressed as one number, as : $7\frac{2}{3}$, $3\frac{1}{4}$, $24\frac{1}{2}$.

ORAL EXERCISE

Read the following :

1. $\frac{5}{8}$, $\frac{3}{4}$, $\frac{11}{12}$, $\frac{7}{15}$, $\frac{2}{3}$, $\frac{3}{7}$, $\frac{9}{5}$, $\frac{11}{16}$.

2. $\frac{15}{4}$, $\frac{75}{100}$, $\frac{28}{39}$, $\frac{37}{25}$, $\frac{17}{50}$, $\frac{281}{300}$.

3. $4\frac{5}{9}$, $28\frac{7}{8}$, $389\frac{4}{15}$, $157\frac{7}{8}$, $36\frac{5}{11}$.

EXERCISE

1. In the preceding examples, arrange the fractions given under the following heads: Proper fractions, improper fractions, and mixed numbers.

2. Write the following fractions or mixed numbers:

- a. Forty-seven sixtieths.
- b. Thirteen thirty-sixths.
- c. Fifteen and four-twelfths.
- d. Eight one-hundredths.
- e. Twenty-five seventy-fifths.
- f. Seventeen nineteenthths.

3. Change to improper fractions:

- | | | | |
|----------------------|----------------------|--------------------|----------------------|
| a. $3\frac{4}{7}$ | b. $4\frac{1}{5}$ | c. $9\frac{2}{7}$ | d. $14\frac{5}{9}$ |
| e. $82\frac{11}{17}$ | f. $35\frac{11}{12}$ | g. $11\frac{5}{6}$ | h. $12\frac{27}{38}$ |

4. Change to mixed numbers:

$$\frac{36}{5}, \frac{17}{3}, \frac{24}{7}, \frac{53}{6}, \frac{19}{4}, \frac{253}{12}$$

5. William has 3 oranges. To each of how many boys can he give $\frac{1}{4}$ of an orange?

6. A man rode a mile each $\frac{1}{16}$ hour. How far did he ride in $2\frac{3}{10}$ hours?

7. Mary has a ribbon $7\frac{5}{8}$ yards long. She cuts it into pieces each $\frac{1}{6}$ of a yard long. How many pieces of ribbon has she?

8. A man gave a quarter out of a five dollar bill to each of 17 boys. How many quarters has he left?

9. If $\frac{3}{4}$ of a yard of cloth is required for a towel, how many towels can be made from $11\frac{1}{4}$ yards?

10. How many more sixths of a yard are there in $5\frac{2}{3}$ yards than in $4\frac{5}{6}$ yards?

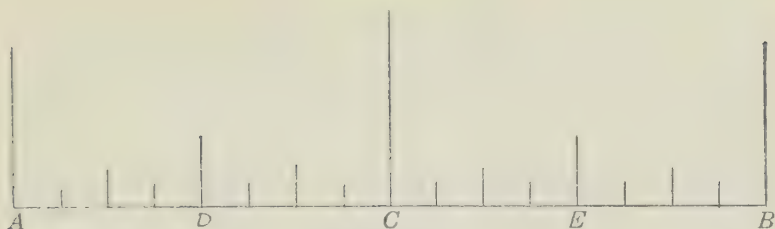


Diagram A

The line AB is divided into 16 equal parts, and at C the line is divided into two equal parts. At D and E , AC and CB are each divided into 2 equal parts, and the line AB at D , C , and E is divided into 4 equal parts.

What part of the line AB is the line AC ?

What part of the line AB is the line AD ?

What part of the line AC is the line AD ?

Mark on the line the following fractions:

$$\frac{3}{4}, \frac{4}{8}, \frac{5}{16}, \frac{1}{2}, \frac{7}{8}, \frac{1}{4}, \text{ etc.}$$

Consider the fractions, $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$. If we multiply the denominators of each of these by 2, we get

$$\frac{1}{2 \times 2} = \frac{1}{4}, \quad \frac{1}{4 \times 2} = \frac{1}{8}, \quad \frac{1}{8 \times 2} = \frac{1}{16}.$$

Compare $\frac{1}{2}$ and $\frac{1}{4}$; $\frac{1}{4}$ and $\frac{1}{8}$; $\frac{1}{8}$ and $\frac{1}{16}$.

By reference to Diagram A, what is the relation of these fractions to each other?

If we multiply the denominator of a fraction by any number, what is the change in the value of the fraction?

Consider the fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$.

Divide the denominators of each of these by 2.

$$\text{We obtain } \frac{1}{2 \div 2} = \frac{1}{1} = 1, \quad \frac{1}{4 \div 2} = \frac{1}{2}, \quad \frac{1}{8 \div 2} = \frac{1}{4}.$$

Dividing the denominator of a fraction by any number produces what change in the value of the fraction?

If we multiply the numerator of a fraction by a number, what change do we make in the value of the fraction?

Illustrate by taking the fractions $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ and multiplying by 2.

If the numerator of a fraction is divided by a number, what change is there in the value of the fraction?

Consider again the line AB , Diagram A. It is divided into four equal parts at D , C , and E , and also into 16 equal parts.

$\frac{1}{4}$ is equal to how many sixteenths?

$\frac{3}{4}$ is equal to how many sixteenths?

$$\begin{array}{rcl} \frac{1}{4} & = & \frac{4}{16} \\ \frac{3}{4} & = & \frac{12}{16} \end{array} \quad \begin{array}{rcl} \frac{4}{16} & & \frac{1}{4} \\ \frac{12}{16} & & \frac{3}{4} \end{array}$$

Both terms of the fraction may be multiplied or divided by the same number without changing the value of the fraction.

A fraction such as $\frac{12}{16}$ is said to be reduced to *lower terms* when it is changed to the fraction $\frac{3}{4}$, where it has a smaller denominator.

A fraction is changed to its *lowest terms* when the terms of the fraction have not a common factor.

$$\frac{8}{16} = \frac{1}{2} \quad \frac{1}{2} = \frac{2}{4}$$

To change a fraction to its lowest terms, divide each term by the H. C. F. of these terms.

Example: Reduce $\frac{36}{60}$ to its lowest terms.

Factors of 36 = $2 \times 2 \times 3 \times 3$

Factors of 60 = $2 \times 2 \times 3 \times 5$

Common factors $2 \times 2 \times 3$

H. C. F. = 12

Dividing both terms by 12.

$$\frac{36}{60} = \frac{3}{5}$$

The work may be shortened by cancellation of common factors in both terms of the fraction.

EXERCISE

Reduce the following fractions to their lowest terms:

- | | | | | |
|---------------------|------------------------|------------------------|------------------------|-------------------------|
| 1. $\frac{15}{20}$ | 2. $\frac{13}{39}$ | 3. $\frac{14}{35}$ | 4. $\frac{24}{36}$ | 5. $\frac{75}{90}$ |
| 6. $\frac{80}{112}$ | 7. $\frac{648}{720}$ | 8. $\frac{288}{364}$ | 9. $\frac{54}{63}$ | 10. $\frac{63}{81}$ |
| 11. $\frac{35}{40}$ | 12. $\frac{264}{1188}$ | 13. $\frac{455}{1092}$ | 14. $\frac{924}{1428}$ | 15. $\frac{1368}{1656}$ |

To reduce an improper fraction to a mixed number.

Example: Reduce $\frac{36}{15}$ to a mixed number.

$$\frac{36}{15} = 36 \div 15 = 2\frac{6}{5} = 2\frac{2}{5}$$

Rule:— Divide the numerator by the denominator.

EXERCISE

Reduce the following improper fractions to mixed numbers:

- | | | | | |
|-------------------|---------------------|---------------------|---------------------|----------------------|
| 1. $\frac{15}{4}$ | 2. $\frac{27}{6}$ | 3. $\frac{82}{9}$ | 4. $\frac{54}{7}$ | 5. $\frac{17}{8}$ |
| 6. $\frac{21}{6}$ | 7. $\frac{125}{24}$ | 8. $\frac{374}{18}$ | 9. $\frac{472}{25}$ | 10. $\frac{526}{15}$ |

To reduce a mixed number to an improper fraction.

Example: Reduce $3\frac{5}{6}$ to an improper fraction.

$$3\frac{5}{6} = 3 + \frac{5}{6}$$

$$3 = \frac{3 \times 6}{6} = \frac{18}{6}$$

$$3\frac{5}{6} = \frac{18}{6} + \frac{5}{6} = \frac{23}{6}$$

Rule. -- To obtain the numerator of the improper fraction, multiply the whole number by the denominator of the fractional part and add the numerator of the fractional part to this product. The denominator of the fractional part will be the denominator of the improper fraction.

EXERCISE

Reduce to improper fractions:

- | | | | |
|---------------------|----------------------|-----------------------|----------------------|
| 1. $3\frac{3}{4}$ | 2. $5\frac{7}{10}$ | 3. $4\frac{8}{11}$ | 4. $17\frac{15}{28}$ |
| 5. $29\frac{5}{8}$ | 6. $18\frac{17}{24}$ | 7. $12\frac{23}{50}$ | 8. $9\frac{7}{5}$ |
| 9. $236\frac{7}{8}$ | 10. $83\frac{7}{13}$ | 11. $27\frac{14}{17}$ | 12. $39\frac{5}{17}$ |

EXERCISE

1. How many whole yards are there in 6 half yards?
2. Twelve quarter hours make how many whole hours?
3. Express each of the following as whole numbers:

$$\frac{6}{2}, \frac{12}{3}, \frac{15}{5}, \frac{18}{9}.$$

4. Write as mixed numbers:

$$\frac{17}{3}, \frac{15}{4}, \frac{17}{6}, \frac{26}{8}.$$

5. Reduce to whole or mixed numbers:

$$\frac{9}{3}, \frac{14}{4}, \frac{24}{8}, \frac{35}{6}, \frac{46}{7}, \frac{21}{9}.$$

Reduce the following improper fractions to whole or mixed numbers:

6. $\frac{45}{7}$

7. $\frac{78}{5}$

8. $\frac{86}{11}$

9. $\frac{97}{4}$

10. $\frac{149}{12}$

11. $\frac{253}{15}$

12. $\frac{725}{45}$

13. $\frac{476}{17}$

14. $\frac{982}{19}$

15. $\frac{4407}{136}$

Reduce the following mixed numbers to improper fractions:

16. $225\frac{73}{106}$

17. $583\frac{9}{5}$

18. $127\frac{7}{11}$

19. $430\frac{3}{15}$

20. $285\frac{7}{8}$

To change a fraction to a fraction of the same value, but having a larger denominator:

Introductory.

ORAL EXERCISE

$\frac{2}{3}$ is how many 8ths?

$\frac{7}{8}$ is how many 24ths?

$\frac{5}{9}$ is how many 27ths?

$\frac{5}{6}$ is how many 36ths?

$\frac{2}{3}$ is how many 15ths?

$\frac{4}{9}$ is how many 36ths?

$\frac{2}{3}$ is how many 12ths?

$\frac{7}{9}$ is how many 28ths?

Example: To change $\frac{1}{3}$ to 6ths.

$$1 = \frac{6}{6}, \frac{1}{3} \text{ of } 1 \text{ is } \frac{1}{3} \text{ of } \frac{6}{6} \text{ or } \frac{2}{6}$$

$$\frac{1}{3} = \frac{2}{6}$$



The line AB is divided at C and D into 3 equal parts. Each part, AC , CD , and DB is $\frac{1}{3}$ of the line. The line AB is divided into 6 equal parts at E , C , F , D , and G . Each part AE , EC , CF , FD , DG , and GB is $\frac{1}{6}$ of the line. By comparing the lengths of AC and AE and EC we see that AC is equal to AE and EC together, that is $\frac{1}{3}$ is equal to $\frac{2}{6}$. From a study of the figure, we also see that

$$\begin{array}{ccc} \frac{1}{3} & \frac{4}{12} & \frac{2}{3} = \frac{4}{6} = \frac{8}{12} \\ \frac{5}{6} & \frac{10}{12} & \frac{3}{6} = \frac{6}{12} \end{array}$$

Example: To change $\frac{2}{3}$ to 18ths.

You may multiply both terms of a fraction by the same number without changing its value.

To change the denominator 3rds to 18ths, we multiply by 6.

Hence, in order that the fraction may not have its value changed we must multiply the numerator by the same number 6.

$$\frac{2}{3} \quad \frac{2 \times 6}{3 \times 6} \quad \frac{12}{18}$$

Rule. — To change a fraction to a fraction having the same value but of larger denominator, write down the new denominator, divide the new denominator by the old denominator, and multiply the numerator by the quotient, for the new numerator.

ORAL EXERCISE

1. Change to 8ths: $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$.
2. Change to 12ths: $\frac{2}{3}$, $\frac{5}{6}$, $\frac{3}{4}$.

3. Change to 10ths: $\frac{1}{2}$, $\frac{1}{5}$, $\frac{3}{5}$, $\frac{4}{5}$.

4. Change to 18ths: $\frac{7}{9}$, $\frac{5}{6}$, $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{9}$.

5. Change $\frac{5}{7}$ to fractions having 14, 21, 28, and 35 as denominators.

6. Change $\frac{5}{6}$ to fractions having 12, 18, 24, 30, and 36 as denominators.

7. Change $\frac{2}{3}$ to fractions having 6, 12, 15, 18, 27, and 36 as denominators.

EXERCISE

- X 1. Change $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{1}{2}$ to 12ths.
 2. Change $\frac{5}{6}$, $\frac{3}{4}$, and $\frac{7}{9}$ to 36ths.
 3. Change $\frac{4}{7}$, $\frac{3}{5}$, and $\frac{7}{10}$ to 70ths.
 4. Change $\frac{5}{8}$, $\frac{2}{7}$, and $\frac{3}{4}$ to 56ths.
 5. Change $\frac{4}{5}$, $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{3}{4}$ to 60ths.
 6. Change $\frac{4}{5}$, $\frac{2}{3}$, and $\frac{5}{7}$ to 105ths.

Fractions having the same denominator are said to be *Similar Fractions*.

Examples: $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{4}$, $\frac{5}{7}$, $\frac{2}{7}$, $\frac{6}{7}$, $\frac{3}{7}$.

Fractions not having the same denominator may be reduced to similar fractions. The smallest common denominator which may serve for several fractions is called their *Least Common Denominator*.

Example: $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$ are not similar fractions. They may be changed to similar fractions with 36 as denominator.

$$\frac{24}{36}, \frac{27}{36}, \text{ and } \frac{30}{36}.$$

They may be changed to similar fractions with 72 as denominator.

$$\frac{48}{72}, \frac{54}{72}, \frac{60}{72}.$$

But 24 is the least common denominator.

From observation it will be seen that the least common denominator of fractions is the L. C. M. of their denominators.

To find the least common denominator of a set of fractions find the L. C. M. of the denominators.

Example :

Reduce $\frac{7}{10}$, $\frac{3}{16}$, and $\frac{5}{24}$ to similar fractions having the least common denominator.

Find the L. C. M. of the denominators.

$$10 = 2 \times 5$$

$$16 = 2 \times 2 \times 2 \times 2$$

$$24 = 2 \times 2 \times 2 \times 3$$

$$\text{L. C. M.} = 2 \times 2 \times 2 \times 2 \times 3 \times 5$$

$$= 240$$

$$\frac{7}{10} = \frac{168}{240}$$

$$\frac{3}{16} = \frac{45}{240}$$

$$\frac{5}{24} = \frac{50}{240}$$

EXERCISE

Change to similar fractions having the least common denominator :

1. $\frac{3}{5}, \frac{4}{7}, \frac{2}{3}$

2. $\frac{2}{3}, \frac{5}{6}, \frac{7}{9}$

3. $\frac{3}{4}, \frac{4}{5}, \frac{3}{10}$

4. $\frac{2}{3}, \frac{3}{7}, \frac{5}{6}$

5. $\frac{7}{24}, \frac{7}{8}, \frac{9}{10}$

6. $\frac{3}{5}, \frac{7}{9}, \frac{17}{30}$

7. $\frac{3}{10}, \frac{16}{25}, \frac{47}{50}, \frac{89}{100}$

8. $\frac{9}{12}, \frac{17}{36}, \frac{1}{3}, \frac{5}{9}$

9. Reduce to 100ths :

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{1}{10}, \frac{1}{20}, \frac{1}{50}, \frac{3}{4}, \frac{3}{5}, \frac{2}{5}, \frac{3}{10},$$

$$\frac{4}{10}, \frac{7}{10}, \frac{9}{10}, \frac{3}{20}, \frac{17}{20}, \frac{11}{20}, \frac{13}{20}, \frac{19}{20}, \frac{17}{25}, \frac{11}{25}$$

Reduce to similar fractions having the least common denominator :

10. $\frac{4}{7}, \frac{5}{11}, \frac{6}{17}$

11. $\frac{7}{8}, \frac{5}{14}, \frac{5}{12}, \frac{17}{42}$

12. $3, 4\frac{3}{4}, 1\frac{7}{16}$

Change the following fractions to similar fractions having the least common denominator and arrange them in order of their values, putting the greatest first :

13. $\frac{3}{4}, \frac{6}{9}, \frac{5}{8}, \frac{7}{12}$

14. $\frac{15}{19}, \frac{18}{21}, \frac{3}{4}$

15. $\frac{9}{16}, \frac{17}{20}, \frac{25}{25}, \frac{4}{5}$

16. $\frac{17}{81}, \frac{13}{18}, \frac{19}{27}, \frac{37}{84}, \frac{5}{9}$

17. $\frac{13}{16}, \frac{7}{9}, \frac{23}{32}, \frac{7}{8}$

18. $\frac{9}{16}, \frac{17}{20}, \frac{43}{50}, \frac{67}{75}$

19. $\frac{2}{3}, \frac{4}{5}, \frac{6}{7}, \frac{11}{15}, \frac{19}{21}, \frac{29}{35}$

20. $\frac{3}{4}, \frac{7}{8}, \frac{13}{16}, \frac{27}{32}, \frac{59}{64}$

EXERCISE

1. From $\$6\frac{3}{8}$ a man paid \$7. How much money had he remaining?

2. John has $\$2\frac{7}{4}$. He pays out \$5. How much money has he left?

3. A number of pies were cut into 5 equal parts. There were 45 pieces. How many pies were there?

4. From $2\frac{1}{2}$ yards of ribbon, $\frac{7}{8}$ yards were cut. How many eighths of a yard remained?

5. If a bottle holds $\frac{1}{3}$ gal., how many gallons will 7 doz. such bottles hold?

6. How far has A gone, if he rides on his bicycle for $\frac{6}{7}$ hr. at the rate of a mile each $\frac{1}{4}$ hour?

7. A man wishes to measure some oats. He has a bucket which holds one-third of a bushel. The oats fill this bucket 167 times. How many bushels of oats are there?

8. The perimeter of a rectangular room is $2\frac{1}{2}$ ft. It is $5\frac{2}{3}$ ft. longer than wide. Find the dimensions of the room.

9. In walking, a man takes 7 steps to a rod. How far has he walked when he has taken 5000 steps?

10. A road 5 mi. long has telegraph poles placed at intervals of $\frac{1}{4}$ mi. How many poles are there?

11. In one scale of a balance there are $\frac{184}{4}$ lb. How many pound weights must be placed in the other scale to balance them?

12. If it takes a man the sixth part of an hour to make a cardboard box, how many hours would he take to make 200 boxes? What is the least number of additional boxes he may make so as to be employed an exact number of hours?

ADDITION AND SUBTRACTION OF FRACTIONS

Introductory.

1. Add 3 cents, 8 cents, and 7 cents.
2. Add 5 yards, 3 yards, and 6 feet.
3. Add 5 pints, 3 quarts, and 2 gallons.
4. Add 2 weeks, 8 weeks, and 10 days.
5. Add 5 tenths, 3 tenths, and 7 tenths.
6. Add 11 twentieths, 7 twentieths, 9 twentieths.
7. Add $\frac{11}{20}$, $\frac{7}{20}$, and $\frac{9}{20}$.
8. Add $\frac{7}{15}$, $\frac{9}{15}$, and $\frac{4}{15}$.
9. Add $\frac{7}{8}$, $\frac{3}{8}$, and $\frac{5}{8}$.
10. Subtract 1 fourth from 3 fourths.
11. Subtract 2 fifths from 4 fifths.
12. Subtract 5 twelfths from 9 twelfths.
13. Subtract $\frac{4}{9}$ from $\frac{7}{9}$.
14. Subtract $\frac{8}{15}$ from $\frac{11}{15}$.

Examples:

1. Add $\frac{3}{4} + \frac{7}{8} + \frac{1}{2}$.

Change to similar fractions having the least common denominator. The least common denominator is 8.

$$\frac{3}{4} = \frac{6}{8} \qquad \frac{7}{8} = \frac{7}{8} \qquad \frac{1}{2} = \frac{4}{8}$$

$$\frac{3}{4} + \frac{7}{8} + \frac{1}{2} = \frac{6}{8} + \frac{7}{8} + \frac{4}{8} = \frac{17}{8} = 2\frac{1}{8}$$

2. Add $\frac{5}{12} + \frac{4}{7} + \frac{2}{3}$.

The least common denominator is 84.

$$\frac{5}{12} + \frac{4}{7} + \frac{2}{3} = \frac{35}{84} + \frac{48}{84} + \frac{56}{84} = \frac{139}{84} = 1\frac{55}{84}$$

3. Subtraction. $\frac{17}{18} - \frac{1}{3}$.

The least common denominator is 18.

$$\frac{17}{18} - \frac{1}{3} = \frac{17}{18} - \frac{6}{18} = \frac{11}{18}$$

4. Add $4\frac{5}{6} + 8\frac{3}{11} + 5\frac{3}{4}$,

Adding the whole numbers $4 + 8 + 5 = 17$.

The least common denominator of the fractions is 132.

$$\frac{5}{6} + \frac{3}{11} + \frac{3}{4} = \frac{110 + 36 + 99}{132} = \frac{245}{132} = 1\frac{113}{132}$$

Adding this to the sum of the whole numbers,

$$17 + 1\frac{113}{132} = 18\frac{113}{132}$$

5. Subtraction. $29\frac{1}{5} - 13\frac{7}{12}$.

The least common denominator is 60.

$$29\frac{1}{5} = 29\frac{12}{60} = 28\frac{72}{60}$$

$$13\frac{7}{12} = 13\frac{35}{60} = \frac{1335}{60}$$

Subtracting :

$$15\frac{37}{60}$$

We cannot take $\frac{35}{60}$ from $\frac{12}{60}$. Take 1 from the 29 leaving 28, and add 1 or $\frac{60}{60}$ to $\frac{12}{60}$ making $\frac{72}{60}$.

To add or subtract fractions, reduce the fractions to similar fractions having the least common denominator.

When mixed numbers are to be added or subtracted, the fractional part may be added or subtracted separately from the whole numbers.

ORAL EXERCISE

1. $\frac{3}{4} + \frac{1}{2}$

2. $\frac{4}{5} + \frac{2}{3}$

3. $\frac{7}{8} + \frac{3}{4}$

4. $\frac{7}{8} - \frac{1}{4}$

5. $\frac{6}{15} - \frac{2}{5}$

6. $\frac{2}{3} + \frac{4}{5}$

7. $\frac{1}{2} + \frac{1}{3} + \frac{3}{4}$

8. $\frac{7}{9} - \frac{2}{5}$

9. $\frac{7}{8} - \frac{3}{5}$

10. $\frac{4}{5} + \frac{3}{10} - \frac{7}{20}$

EXERCISE

Add or subtract as indicated :

- | | | |
|---|--|--|
| 1. $\frac{1}{2} + \frac{3}{4} + \frac{2}{3}$ | 2. $\frac{1}{2} + \frac{2}{5} + \frac{7}{8}$ | 3. $\frac{4}{25} + \frac{9}{40} + \frac{3}{20}$ |
| 4. $\frac{17}{20} - \frac{4}{5}$ | 5. $\frac{9}{35} - \frac{7}{30}$ | 6. $\frac{3}{4} + \frac{5}{6} - \frac{2}{3}$ |
| 7. $\frac{19}{20} + \frac{7}{8} - \frac{4}{5}$ | 8. $\frac{15}{16} - \frac{6}{7} + \frac{7}{8}$ | 9. $\frac{11}{12} + \frac{7}{18} - \frac{9}{20}$ |
| 10. $\frac{4}{9} + \frac{7}{8} - \frac{4}{5} + \frac{5}{9}$ | | |

EXERCISE

- | | |
|--|---|
| 1. $3\frac{3}{4} + 5\frac{4}{7} + 7\frac{1}{2}$ | 2. $15\frac{3}{4} + 12\frac{2}{5} + 12\frac{2}{3}$ |
| 3. $15\frac{7}{8} + 23\frac{4}{9} + 17\frac{1}{3}$ | 4. $29\frac{3}{8} + 17\frac{7}{16} + 9\frac{2}{3}$ |
| 5. $59\frac{8}{9} + 26\frac{4}{27} + 7\frac{13}{18}$ | 6. $9\frac{7}{10} + 28\frac{17}{20} + 15\frac{9}{50}$ |
| 7. $28\frac{2}{3} - 15\frac{1}{2}$ | 8. $19\frac{3}{8} - 15\frac{4}{7}$ |
| 9. $238\frac{7}{9} - 119\frac{11}{18}$ | 10. $328\frac{5}{8} - 198\frac{5}{8}$ |

EXERCISE

Add first, then subtract each of the following :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1. $15\frac{1}{2}$ <u>$9\frac{3}{4}$</u>	$26\frac{3}{4}$ <u>$17\frac{7}{8}$</u>	$19\frac{5}{6}$ <u>$7\frac{7}{8}$</u>	$25\frac{4}{7}$ <u>$13\frac{19}{21}$</u>	$15\frac{2}{9}$ <u>$7\frac{2}{3}$</u>
2. $73\frac{2}{3}$ <u>$16\frac{5}{12}$</u>	$89\frac{5}{9}$ <u>$46\frac{11}{12}$</u>	$75\frac{4}{7}$ <u>$28\frac{29}{56}$</u>	$83\frac{1}{4}$ <u>$39\frac{8}{5}$</u>	$27\frac{5}{7}$ <u>$19\frac{3}{4}$</u>
3. $89\frac{3}{4}$ <u>$29\frac{7}{9}$</u>	$37\frac{5}{6}$ <u>$19\frac{1}{2}$</u>	$48\frac{5}{6}$ <u>$19\frac{5}{7}$</u>	$65\frac{5}{8}$ <u>$37\frac{5}{7}$</u>	$43\frac{2}{9}$ <u>$36\frac{5}{8}$</u>

Add :

- | | | | |
|--|---|---|---|
| 4. $26\frac{2}{3}$
$38\frac{5}{7}$
<u>$49\frac{1}{6}$</u> | $39\frac{7}{15}$
$54\frac{2}{5}$
<u>$82\frac{3}{10}$</u> | $28\frac{3}{8}$
$75\frac{11}{16}$
<u>$94\frac{5}{8}$</u> | $47\frac{4}{5}$
$23\frac{5}{6}$
<u>$89\frac{3}{8}$</u> |
|--|---|---|---|

Simplify :

- | | |
|---|---|
| 5. $\frac{3}{4} + \frac{2}{9} + \frac{5}{7} + \frac{1}{3}$ | 6. $\frac{4}{9} + \frac{2}{3} + \frac{6}{7} + \frac{4}{21}$ |
| 7. $\frac{5}{9} + \frac{2}{5} + \frac{1}{3} + \frac{5}{8}$ | 8. $\frac{8}{9} + \frac{5}{8} + \frac{3}{4} + \frac{4}{7}$ |
| 9. $2\frac{1}{2} + 4\frac{5}{9} - 3\frac{3}{4} - \frac{7}{3}$ | 10. $5\frac{5}{8} - 3\frac{4}{9} + 4\frac{2}{3} + 7\frac{3}{4}$ |
| 11. $\frac{5}{9} + 3\frac{7}{8} + 4\frac{1}{18} - 5\frac{5}{6}$ | 12. $7\frac{4}{7} + 5\frac{3}{5} - 8\frac{2}{5} + 7\frac{7}{8}$ |
| 13. $50\frac{5}{8} - 4\frac{3}{4} - 8\frac{1}{9} - 5\frac{7}{36}$ | 14. $11\frac{3}{11} - 7\frac{5}{22} + 14\frac{1}{55} - 3\frac{7}{10}$ |

EXERCISE

1. A farmer sold to one customer $6\frac{1}{2}$ bushels of potatoes, to another $5\frac{3}{4}$ bushels, and to a third $7\frac{2}{3}$ bushels. How many bushels did he sell to the three?

2. One box of provisions is $2\frac{5}{8}$ lbs. heavier than a second box. The lighter box weighs $18\frac{2}{3}$ lbs. What is the weight of both boxes?

3. One number is $14\frac{3}{8}$, a second one is $2\frac{4}{5}$ greater than this, and a third one is $4\frac{5}{12}$ greater than the second. Find the sum of the three numbers.

Find the sum of the following fractions :

4. $2\frac{1}{3}$, $7\frac{3}{4}$, $9\frac{5}{6}$, $6\frac{7}{8}$, $9\frac{1}{2}$.
5. $2\frac{1}{3}$, $\frac{5}{12}$, $6\frac{7}{18}$, $7\frac{4}{9}$, $9\frac{3}{4}$.
6. $3\frac{4}{5}$, $14\frac{7}{10}$, $12\frac{5}{6}$, $9\frac{7}{12}$.
7. $4\frac{2}{5}$, $3\frac{1}{3}$, $6\frac{5}{9}$, $25\frac{7}{15}$, $9\frac{3}{4}$.

8. One piece of cloth contains $7\frac{4}{5}$ yards, a second piece $13\frac{3}{4}$ yards, a third $2\frac{5}{8}$ yards, a fourth $9\frac{2}{3}$ yards, and a fifth $35\frac{4}{5}$ yards. How much cloth is there in the five pieces?

9. A certain town A is $35\frac{1}{2}$ miles west of another town B, a third town C is $18\frac{5}{6}$ miles east of B, and a town D is $27\frac{1}{3}$ miles east of C. Draw a diagram and find the distance between A and D.

10. A farmer sold $145\frac{3}{4}$ bushels of wheat, $356\frac{2}{3}$ bushels of oats, $567\frac{5}{8}$ bushels of barley, and $764\frac{3}{8}$ bushels of rye. How much grain did he sell altogether?

EXERCISE

1. To make a raffia basket a girl requires $\frac{5}{8}$ lbs. of plain raffia, $\frac{1}{4}$ lb. red raffia, and $\frac{1}{8}$ lb. of green raffia. What is the weight in ounces of the raffia in the basket?

2. I bought $\frac{7}{8}$ of a yard of silk, $\frac{3}{4}$ of a yard of poplin, $\frac{2}{3}$ of a yard of velvet, and $\frac{5}{6}$ of a yard of satin. How many yards did I purchase in the four pieces?

3. John lives $\frac{3}{4}$ miles from school, William lives $\frac{1}{3}$ of a mile farther than John, and Robert lives $\frac{2}{3}$ of a mile farther than William. Find the distance in yards each boy has to go to reach the school. (Answering)

4. Two boys planted a garden. They had $\frac{3}{4}$ acre planted in potatoes, $\frac{1}{5}$ acre planted in onions, $\frac{1}{3}$ acre planted in cabbages, and $\frac{5}{6}$ acre planted in beets and carrots. How many acres were there in the garden?

5. Four boys ran a relay race. The first boy took $9\frac{2}{3}$ seconds, the second boy $8\frac{7}{8}$ seconds, the third $10\frac{2}{3}$ seconds, and the fourth $9\frac{5}{8}$ seconds. How long did it take the four boys to run the race? ✓

6. A farmer has a field of alfalfa. The first cutting he had $17\frac{5}{8}$ tons, the second cutting $11\frac{3}{4}$ tons, and the third cutting $9\frac{5}{8}$ tons. How many tons did he get from the three cuttings?

7. The rainfall at Portage la Prairie for 5 months was as follows: April $1\frac{5}{8}$ inches, May $2\frac{3}{4}$ inches, June $3\frac{1}{2}$ inches, July $3\frac{7}{10}$ inches, and August $1\frac{1}{2}$ inches. What was the total rainfall for the five months?

8. Three boys went on a walking trip. The first day they walked $9\frac{3}{4}$ miles, the second day $12\frac{1}{2}$ miles, the third day $10\frac{5}{8}$ miles, and the last day $8\frac{5}{8}$ miles. How far did they walk in the four days?

9. A dealer bought 6 turkeys, the weights of which were $19\frac{3}{4}$ lbs., $17\frac{5}{8}$ lbs., $24\frac{1}{8}$ lbs., $18\frac{1}{2}$ lbs., $22\frac{1}{4}$ lbs., and $19\frac{4}{5}$ lbs. Find the total weight of the turkeys.

10. A boy took a summer vacation, travelling $235\frac{1}{2}$ miles by train, $78\frac{3}{4}$ miles by automobile, $47\frac{4}{5}$ miles by steamer, and $39\frac{2}{3}$ miles by pack pony. How far did he travel on his trip?

EXERCISE

1. A man spends $\frac{1}{3}$ of his salary for food, $\frac{1}{8}$ for clothes, and $\frac{1}{16}$ for rent. What part of his salary does he spend altogether?

2. A dealer sold 4 loads of coal. The first weighed $\frac{3}{4}$ of a ton, the second $\frac{2}{3}$ of a ton, the third $\frac{7}{8}$ of a ton, and the fourth $\frac{5}{6}$ of a ton. How many tons of coal did the dealer sell?

3. A man has a journey to make. The first day he travelled $\frac{2}{3}$ of it, the second day $\frac{1}{5}$ of it, and the third day $\frac{2}{5}$ of it. What part of the journey has he gone in the 3 days?

4. At a picnic the following amounts of refreshments were provided: $2\frac{3}{8}$ gallons of coffee, $5\frac{5}{8}$ gallons of milk, $4\frac{1}{3}$ gallons of tea, and $8\frac{4}{5}$ gallons of lemonade. How many gallons were there altogether?

5. A man drove $18\frac{3}{4}$ miles the first hour, $23\frac{4}{5}$ miles the second hour, $19\frac{7}{8}$ miles the third hour, and $26\frac{5}{6}$ miles the fourth hour. How far did he go in the four hours? If he has to travel 95 miles, how much further has he to go?

6. If a room is $17\frac{3}{4}$ feet wide and $22\frac{5}{6}$ feet long, how far is the total distance around the room? How much greater is the length of the room than its width?

7. A woman sold 4 tubs of butter. The first tub weighed $25\frac{1}{4}$ lbs., the second $26\frac{5}{8}$ lbs., the third $27\frac{7}{8}$ lbs., and the fourth $30\frac{1}{5}$ lbs. Find the total weight of the four tubs of butter.

8. The first number is $23\frac{3}{8}$, the second number is $7\frac{1}{4}$ greater than the first, the third number is $9\frac{3}{8}$ less than the first. Find the sum of the three numbers.

9. A certain town A is $18\frac{3}{4}$ miles west of a town B, another town C is $17\frac{2}{5}$ miles east of B, and another town D is $35\frac{1}{8}$ miles east of C. Draw a diagram showing the positions of the towns, and find the total distance between A and D.

10. A farmer sold $1897\frac{7}{8}$ bushels of oats, $2486\frac{2}{3}$ bushels of wheat, and $986\frac{5}{8}$ bushels of barley. How much grain did he sell altogether?

11. A farmer owns three pieces of land. The first contains $79\frac{3}{8}$ acres, the second $118\frac{6}{5}$ acres, and the third $87\frac{1}{2}\frac{9}{1}$ acres. How much land are in the three pieces?

12. A field is $387\frac{3}{4}$ yards long and $168\frac{7}{8}$ yards wide. What is the length of the fence around the field?

13. A dealer bought 384 tons of coal. He sold $18\frac{4}{5}$ tons to one customer, $189\frac{3}{4}$ tons to a second, $59\frac{5}{8}$ tons to a third, and $29\frac{5}{8}$ tons to a fourth. How much coal has he left?

14. A grocer mixed $15\frac{3}{4}$ lbs. tea with $39\frac{1}{2}\frac{1}{1}$ lbs. of another kind. He sold $28\frac{1}{2}\frac{1}{2}$ lbs. of the mixture. How much did he have left?

15. In a relay race the first boy took $6\frac{3}{4}$ seconds to run his part of the course, the second boy $5\frac{2}{3}$ seconds, the third $5\frac{1}{8}$ seconds, and the fourth $4\frac{1}{2}\frac{1}{2}$ seconds. How long did it take to run the race? How much less than $\frac{1}{2}$ a minute did it take to run the race?

16. From a board 18 feet long a man sawed off 3 pieces of the following lengths: $5\frac{1}{3}$ feet, $2\frac{3}{4}$ feet, and $4\frac{7}{8}$ feet. What length remained?

17. The rainfall at Edmonton for a certain year was as follows: January $2\frac{3}{4}$ inches, February $1\frac{7}{10}$ inches. March

$\frac{5}{12}$ inch, April $1\frac{3}{5}$ inches, May $2\frac{3}{5}$ inches, June $3\frac{1}{2}$ inches, July $1\frac{9}{10}$ inches, August $\frac{5}{8}$ inch, September $\frac{3}{10}$ inch, October $\frac{7}{12}$ inch, November $\frac{9}{10}$ inch, and December $1\frac{3}{4}$ inches. Find the total rainfall for the year.

18. A steamship burns the following amounts of coal on a five-day voyage: first day $89\frac{3}{4}$ tons, second day $118\frac{2}{5}$ tons, third day $129\frac{5}{7}$ tons, fourth day $98\frac{5}{8}$ tons, fifth day $119\frac{1}{6}$ tons. Find the total amount of coal used.

19. There are three numbers the sum of which is 279. The first number is $28\frac{5}{8}$ greater than the second, and the second is $15\frac{7}{12}$ greater than the third. Find the numbers.

20. A owns $71\frac{7}{8}$ acres of land; B owns $29\frac{5}{12}$ acres more than A; C owns $157\frac{1}{24}$ acres more than B; and D owns $73\frac{1}{2}$ acres more than C. How many acres do they together own?

Cancellation in Fractions

We may divide the numerator and denominator of a fraction by the same factor. This process is called *cancellation*.

Example:

Reduce $\frac{56}{42}$ to a mixed number.

$$\frac{56}{42} = \frac{7 \times 4 \times 2}{7 \times 3 \times 2}$$

We may cancel the common factors 7 and 2 in the numerator and the denominator by dividing by these numbers.

$$= \frac{4}{3} = 1\frac{1}{3}$$

Or,

$$\frac{4}{3}$$

$$\frac{56}{42} = \frac{4}{3} = 1\frac{1}{3}$$

Divide first by 7. Then divide by 2.

$$\frac{4}{3}$$

EXERCISE

Find the value of each of the following in the lowest terms by cancellation :

1. $\frac{540}{315}$

2. $\frac{1008}{105}$

3. $\frac{9 \times 5 \times 36 \times 7}{21 \times 8 \times 15}$

4. $\frac{14 \times 8 \times 30 \times 63}{28 \times 72 \times 25 \times 9}$

5. $\frac{27 \times 36 \times 45 \times 17}{18 \times 9 \times 51 \times 25}$

6. $\frac{125 \times 72 \times 24 \times 44}{75 \times 9 \times 33 \times 8}$

7. $\frac{3}{4} \times \frac{12}{15} \times \frac{9}{16} \times \frac{20}{24}$

8. $\frac{9}{12} \times \frac{27}{45} \times \frac{18}{24} \times \frac{56}{72}$

9. $\frac{210}{78} \times \frac{3}{4} \times \frac{195}{63} \times \frac{18}{24} \times \frac{72}{125}$

Multiplication of Fractions

EXERCISE

Introductory.

1. Draw a line 1 foot long and find $\frac{2}{3}$ of it.
2. Draw a line $\frac{3}{4}$ of a foot long and find $\frac{2}{3}$ of it.
3. Draw a rectangle 5 inches by 2 inches and find the area of $\frac{4}{5}$ of it.
4. Draw a rectangle 12 inches long and 1 inch wide and mark off $\frac{3}{4}$ of it ; then find the area of $\frac{1}{3}$ of the part you have marked off.
5. How do you find $\frac{2}{3}$ of a foot ? $\frac{4}{5}$ of a rectangle ?
6. How do you find $\frac{2}{3}$ of $\frac{3}{4}$ of a foot ? $\frac{1}{3}$ of $\frac{3}{4}$ of a rectangle ?
7. Find $\frac{1}{3}$ of $\frac{1}{4}$ of 120.
8. Show by folding paper that :

$$\frac{1}{2} \text{ of } \frac{1}{3} = \frac{1}{6}$$

$$\frac{1}{2} \text{ of } \frac{1}{4} = \frac{1}{8}$$

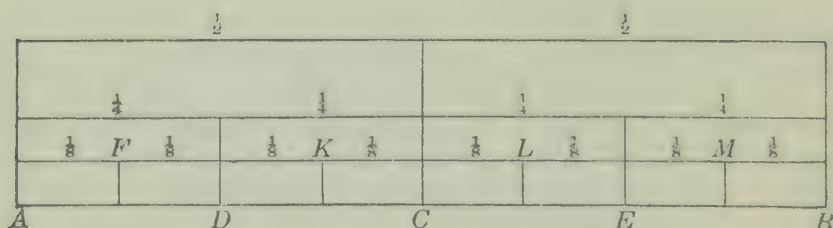
$$\frac{1}{3} \text{ of } \frac{1}{4} = \frac{1}{12}$$

9. What is one half of 6 ninths? of 10 elevenths? of 16 twentieths?

10. Find $\frac{1}{3}$ of the following: $\frac{12}{17}$, $\frac{15}{22}$, $\frac{18}{5}$.

11. Find $\frac{2}{5}$ of the following: 20, $\frac{20}{27}$, $\frac{25}{31}$.

12. A boy had $\frac{1}{3}$ of a dollar and he lost $\frac{1}{4}$ of what he had. What part of a dollar did he lose?



The line AB is divided into 8 equal parts. Each part is $\frac{1}{8}$ of the whole line.

At C the line AB is divided into 2 equal parts. Each part is $\frac{1}{2}$ of the whole line.

At D and E , AC and CB are divided each into 2 equal parts. Each part is $\frac{1}{4}$ of the whole line.

$AC = \frac{4}{8}$ of the whole line

$AC = \frac{2}{4}$ of the whole line

$AC = \frac{1}{2}$ of the whole line

4 times $\frac{1}{8}$ of the line $= \frac{4}{8}$ of the line $= \frac{2}{4}$ of the line $= \frac{1}{2}$ of the line.

If we multiply the numerator of a fraction by any number, we increase the value of the fraction, *e.g.* 4 times $\frac{1}{8} = \frac{4}{8} = \frac{1}{2}$.

If we divide the denominator of a fraction by any number, we increase the value of the fraction, *e.g.* dividing the denominator of the fraction $\frac{1}{8}$ by 4 we get $\frac{1}{8 \div 4} = \frac{1}{2}$, which is the same as multiplying the numerator of the fraction by 4.

Multiplying the numerator of a fraction by any number increases the number of equal parts, and hence multiplies the fraction.

Dividing the denominator by any number increases the size of the equal parts, and hence multiplies the fraction.

ORAL EXERCISE

- | | | | |
|----------------------------|------------------------------|-------------------------------|------------------------------|
| 1. $4 \times \frac{3}{4}$ | 2. $5 \times \frac{7}{10}$ | 3. $6 \times \frac{5}{6}$ | 4. $7 \times \frac{4}{7}$ |
| 5. $6 \times \frac{8}{12}$ | 6. $7 \times \frac{6}{14}$ | 7. $5 \times \frac{7}{10}$ | 8. $9 \times \frac{7}{18}$ |
| 9. $5 \times \frac{7}{8}$ | 10. $17 \times \frac{7}{51}$ | 11. $13 \times \frac{28}{39}$ | 12. $11 \times \frac{6}{77}$ |

Example:

$$\frac{7}{8} = 7 \text{ times } \frac{1}{8}, \text{ or } \frac{7}{8} = \frac{1}{8} \text{ of } 7, \text{ or } 7 \div 8$$

Find $\frac{7}{8}$ of 24.

$$\begin{aligned} \frac{7}{8} \text{ of } 24 &= 7 \text{ times } \frac{1}{8} \text{ of } 24 = 7 \times \frac{1}{8} \text{ of } 24 \\ &= 7 \times 3 = 21 \end{aligned}$$

We use the word "of" for multiplication

Thus $\frac{7}{8} \times \frac{5}{7}$ is read $\frac{7}{8}$ of $\frac{5}{7}$.

Find $\frac{7}{8}$ of $\frac{5}{7}$.

$$\frac{7}{8} \text{ of } \frac{5}{7} = \frac{7 \times 5}{8 \times 7} = \frac{35}{56}$$

To find $\frac{7}{8}$ of any number we divide the number into 8 equal parts and take 7 of them. To find $\frac{7}{8}$ of $\frac{5}{7}$ we

Reducing to the lowest terms we get $\frac{5}{8}$: or divide $\frac{5}{7}$ into 8 parts, obtaining $\frac{5}{8 \times 7}$,
 $\frac{7}{8}$ of $\frac{5}{7} = \frac{7 \times 5}{8 \times 7} = \frac{5}{8}$ and taking 7 of these we get $\frac{7 \times 5}{8 \times 7} = \frac{35}{56}$

Rule: To multiply a fraction by a fraction, multiply the numerators together for the new numerator and multiply the denominators together for the new denominator.

Reduce the new fraction to its lowest terms by cancelling factors common to denominator and numerator.

Example:

Multiply $6\frac{2}{3}$ by $7\frac{4}{5}$.

$$6\frac{2}{3} = \frac{20}{3}$$

$$7\frac{4}{5} = \frac{39}{5}$$

$$\begin{array}{r} 13 \\ 4 \end{array}$$

$$7\frac{4}{5} \times 6\frac{2}{3} = \frac{39}{5} \times \frac{20}{3} = \frac{39}{5} \times \frac{20}{3} = 52$$

Example:

Find the value of : $\frac{3}{4}$ of $\frac{8}{9} \times \frac{15}{16}$

$$\frac{3}{4} \text{ of } \frac{8}{9} \times \frac{15}{16} = \frac{3 \times 8 \times 15}{4 \times 9 \times 16}$$

By cancellation.

$$\begin{array}{r} 2 \quad 5 \\ \frac{3 \times 8 \times 15}{4 \times 9 \times 16} = \frac{5}{8} \\ \quad 3 \quad 8 \end{array}$$

ORAL EXERCISE

<i>a</i>	<i>b</i>	<i>c</i>
1. $4 \times \frac{5}{8}$	$3 \times \frac{7}{9}$	$5 \times \frac{7}{10}$
2. $3 \times \frac{4}{5}$	$\frac{2}{3}$ of $\frac{6}{7}$	$\frac{4}{5}$ of $\frac{10}{12}$
3. $\frac{7}{8}$ of $\frac{3}{4}$	$\frac{2}{7}$ of $\frac{3}{11}$	$\frac{5}{12}$ of $\frac{3}{4}$
4. $\frac{9}{11}$ of $\frac{22}{27}$	$\frac{4}{5}$ of $\frac{15}{24}$	$\frac{3}{7}$ of $\frac{14}{15}$
5. $\frac{4}{7}$ of 35	$\frac{8}{9}$ of 72	$\frac{5}{11}$ of 77
6. $3\frac{1}{3} \times 2$	$5\frac{3}{4} \times 4$	$66\frac{2}{3} \times 30$
7. $12\frac{1}{2} \times 8$	$6\frac{1}{4}$ by 40	$16\frac{2}{3} \times 30$
8. $\frac{4}{5} \times \frac{15}{20}$	$\frac{3}{4}$ of $\frac{12}{21}$	$\frac{4}{9}$ of $\frac{18}{24}$
9. $\frac{13}{20} \times \frac{5}{39}$	$\frac{11}{17} \times \frac{34}{77}$	$\frac{19}{20} \times \frac{60}{76}$
10. $\frac{7}{9}$ of $5\frac{1}{7}$	$\frac{2}{3}$ of $16\frac{1}{5}$	$\frac{7}{8}$ of $9\frac{2}{8}$

EXERCISE

Find the value of :

1. $\frac{5}{6} \times 18$
2. $\frac{8}{9}$ of 45
3. $\frac{5}{6}$ of 45
4. $\frac{7}{19} \times 76$
5. $\frac{12}{15}$ of $\frac{9}{10}$
6. $\frac{9}{10}$ of $\frac{5}{21} \times \frac{7}{25}$
7. $3\frac{1}{4} \times 5\frac{2}{7}$
8. $6\frac{2}{3} \times 7\frac{2}{5}$
9. $17\frac{2}{5} \times 16\frac{2}{3}$
10. $\frac{10}{11} \times \frac{3}{10} \times \frac{7}{12}$
11. $\frac{7}{8} \times \frac{4}{5} \times \frac{13}{14}$
12. $39\frac{3}{5} \times 33\frac{1}{3}$
13. $5\frac{2}{7} \times 4\frac{3}{11} \times 4\frac{1}{4}$
14. $3 \times 7\frac{1}{2} \times \frac{11}{45} \times 3\frac{8}{11}$
15. $37\frac{1}{2} \times \frac{4}{7}$ of $\frac{21}{50}$
16. $\frac{4}{7} \times \frac{14}{35} \times \frac{5}{8} \times \frac{35}{19}$
17. $16\frac{2}{3} \times 12\frac{1}{2} \times \frac{12}{25}$ of $\frac{3}{50}$
18. $87\frac{1}{2} \times \frac{36}{55}$ of $\frac{5}{6} \times \frac{33}{50}$
19. $\frac{7}{8}$ of $\frac{4}{21}$ of $\frac{4}{5}$ of 125 square inches
20. $\frac{5}{8} \times \frac{12}{25} \times \frac{2}{3}$ of $4\frac{3}{5}$ tons

ALIUOT PARTS

Introductory.

25 cents is contained in \$1.00 exactly *four times*, or

$$$.25 = $\frac{1}{4}$ of $1.00$$

$$25 = \frac{1}{4} \text{ of } 100$$

$$250 = \frac{1}{4} \text{ of } 1000$$

The following relations are evident :

$$20 = \frac{1}{5} \text{ of } 100$$

$$12\frac{1}{2} = \frac{1}{8} \text{ of } 100$$

$$33\frac{1}{3} = \frac{1}{3} \text{ of } 100$$

$$16\frac{2}{3} = \frac{1}{6} \text{ of } 100$$

$$50 = \frac{1}{2} \text{ of } 100$$

$$66\frac{2}{3} = \frac{2}{3} \text{ of } 100$$

25, 20, 50, $33\frac{1}{3}$, $12\frac{1}{2}$, $16\frac{2}{3}$, $66\frac{2}{3}$ are *aliquot parts* of 100.An *aliquot part* of a number is a part that divides that number exactly.*Multiplying by the method of aliquot parts.*

$$25 \times 36 = \frac{1}{4} \text{ of } 100 \times 36 = \frac{1}{4} \text{ of } 3600 = 900$$

$$\text{or } 25 \times 36 = \frac{1}{4} \text{ of } 36 \times 100 = 9 \times 100 = 900$$

$$33\frac{1}{3} \times 18 = \frac{1}{3} \text{ of } 100 \times 18 = \frac{1}{3} \text{ of } 1800 = 600$$

$$\text{or } 33\frac{1}{3} \times 18 = \frac{1}{3} \text{ of } 18 \times 100 = 6 \times 100 = 600$$

ORAL EXERCISE

How shall we multiply by the following numbers, using the method of aliquot parts?

50, 25, 20, 10, $6\frac{1}{4}$, $16\frac{2}{3}$, $12\frac{1}{2}$

EXERCISE

At sight give the products of the following:

- | | | | |
|------------------------------|------------------------------|------------------------------|------------------------------|
| 1. 25×64 | 2. 20×65 | 3. 50×36 | 4. $16\frac{2}{3} \times 72$ |
| 5. $33\frac{1}{3} \times 18$ | 6. $12\frac{1}{2} \times 64$ | 7. $6\frac{1}{4} \times 32$ | 8. 25×72 |
| 9. $16\frac{2}{3} \times 48$ | 10. 20×85 | 11. $6\frac{1}{4} \times 64$ | 12. 25×360 |

Memorize the following table of aliquot parts:

$50 = \frac{1}{2}$ of 100	$33\frac{1}{3} = \frac{1}{3}$ of 100
$25 = \frac{1}{4}$ of 100	$16\frac{2}{3} = \frac{1}{6}$ of 100
$20 = \frac{1}{5}$ of 100	$12\frac{1}{2} = \frac{1}{8}$ of 100
$10 = \frac{1}{10}$ of 100	$6\frac{1}{4} = \frac{1}{16}$ of 100

EXERCISE

Using the method of aliquot parts find the following products:

- | | | |
|-------------------------------|--------------------------------|--------------------------------|
| 1. 25×384 | 2. 50×537 | 3. 20×289 |
| 4. $33\frac{1}{3} \times 267$ | 5. $16\frac{2}{3} \times 426$ | 6. $6\frac{1}{4} \times 512$ |
| 7. $12\frac{1}{2} \times 384$ | 8. 25×683 | 9. 10×783 |
| 10. 50×4329 | 11. $6\frac{1}{4} \times 2048$ | 12. $16\frac{2}{3} \times 744$ |

13. Find the cost of 36 yards of cheesecloth at $16\frac{2}{3}$ cents per yard.

14. Find the cost of 48 yards of cotton at $12\frac{1}{2}$ cents per yard.

15. Eggs are sold at the rate of 3 dozen for a \$1.00. Find the cost of 45 dozen eggs.

16. Find the cost of 258 drawing sets at $12\frac{1}{2}$ cents per set.

Division of Fractions

To divide a fraction by a whole number :

Introductory.

$$\frac{1}{2} \text{ of } 4 \text{ ninths} = 2 \text{ ninths}$$

$$\frac{1}{2} \text{ of } \frac{4}{9} = \frac{2}{9}, \text{ or } \frac{4}{9} \div 2 = \frac{2}{9}$$

$$\frac{1}{2} \text{ of } 6 \text{ elevenths} = 3 \text{ elevenths}$$

$$\frac{1}{2} \text{ of } \frac{6}{11} = \frac{3}{11}, \text{ or } \frac{6}{11} \div 2 = \frac{3}{11}$$

$$\frac{1}{3} \text{ of } 6 \text{ sevenths} = 2 \text{ sevenths}$$

$$\frac{1}{3} \text{ of } \frac{6}{7} = \frac{2}{7}, \text{ or } \frac{6}{7} \div 3 = \frac{2}{7}$$

Multiplying the denominator of $\frac{6}{7}$ by 3, we have the result $\frac{6}{21}$.

Reducing $\frac{6}{21}$ to its lowest terms, we get the fraction $\frac{2}{7}$.

Comparing $\frac{6}{7 \times 3}$ with $\frac{6}{7} \div 3$, we see that the results are the same.

Rule. — To divide a fraction by a whole number, divide the numerator of the fraction or multiply the denominator of the fraction, by the whole number.

EXERCISE

Find the value of the following :

1. $\frac{8}{9} \div 2$

6. $\frac{10}{7} \div 5$

11. $11\frac{1}{4} \div 5$

2. $\frac{12}{3} \div 6$

7. $\frac{14}{8} \div 7$

12. $16\frac{5}{8} \div 19$

3. $\frac{14}{7} \div 7$

8. $\frac{2}{9} \div 8$

13. $73\frac{1}{2} \div 7$

4. $\frac{3}{4} \div 2$

9. $\frac{20}{5} \div 5$

14. $43\frac{1}{2} \div 47$

5. $\frac{5}{8} \div 3$

10. $\frac{42}{9} \div 7$

15. $353\frac{1}{8} \div 25$

To divide a fraction or a whole number by a fraction.

Example :

Divide $\frac{2}{3}$ by $\frac{5}{7}$.

$$\frac{2}{3} \div \frac{5}{7} = \left(\frac{2}{3} \times \frac{7}{5}\right) \div \left(\frac{5}{7} \times \frac{7}{5}\right)$$

Since multiplying dividend and divisor by the same number does not change the value of the quotient :

$$\begin{aligned} & \left(\frac{2}{3} \times \frac{7}{5}\right) \div \left(\frac{5}{7} \times \frac{7}{5}\right) \\ &= \frac{2}{3} \times \frac{7}{5} \div 1 = \frac{14}{15} \div 1. \\ & \frac{14}{15} = \frac{2 \times 7}{3 \times 5}. \end{aligned}$$

That is, to divide by $\frac{5}{7}$ invert the fraction and multiply.

Rule. — Any number may be divided by a fraction by inverting the terms of the fraction which is the divisor, and multiplying.

Example:

Divide $2\frac{3}{4}$ by $1\frac{1}{2}$.

$$\begin{aligned} 2\frac{3}{4} &= \frac{11}{4} & 1\frac{1}{2} &= \frac{3}{2} \\ 2\frac{3}{4} \div 1\frac{1}{2} &= \frac{11}{4} \div \frac{3}{2} \\ &= \frac{11}{4} \times \frac{2}{3} = \frac{22}{12} = \frac{11}{6} = 1\frac{5}{6} \end{aligned}$$

Example:

Divide 48 by $1\frac{3}{5}$.

$$\begin{aligned} 1\frac{3}{5} &= \frac{8}{5} \\ 48 \div 1\frac{3}{5} &= 48 \div \frac{8}{5} \\ &= 48 \times \frac{5}{8} = \frac{48 \times 5}{8} = 30 \end{aligned}$$

EXERCISE

Divide :

- | | | |
|-------------------------|--|---|
| 1. 10 by $\frac{5}{7}$ | 5. $\frac{3}{4}$ by $1\frac{7}{2}$ | 9. $9\frac{3}{4}$ by $1\frac{2}{10}$ |
| 2. 18 by $\frac{3}{8}$ | 6. $1\frac{5}{7}$ by $\frac{9}{16}$ | 10. $7\frac{5}{24}$ by $12\frac{8}{15}$ |
| 3. 30 by $\frac{6}{7}$ | 7. $1\frac{3}{14}$ by $1\frac{7}{5}$ | 11. $21\frac{3}{7}$ by $12\frac{8}{21}$ |
| 4. 40 by $3\frac{1}{2}$ | 8. $1\frac{85}{88}$ by $1\frac{5}{22}$ | 12. $45\frac{3}{5}$ by $2\frac{6}{9}$ |

Find the quotients :

13. $16\frac{2}{3} \div 14\frac{1}{2}$

17. $\frac{5}{8} \div 12\frac{3}{4}$

14. $62\frac{1}{2} \div 16\frac{2}{3}$

18. $\frac{7}{10} \div 16\frac{4}{5}$

15. $87\frac{1}{2} \div 37\frac{1}{2}$

19. $15\frac{7}{8} \div 3\frac{1}{4}$

16. $28\frac{4}{7} \div \frac{25}{16}$

20. $\frac{5}{9} \div 3\frac{24}{7}$

EXERCISE

1. A shipment of salt weighed 6120 lbs. How many sacks weighing $25\frac{1}{2}$ lbs. each were in the shipment?

2. A barrel holds $2\frac{3}{4}$ bushels of apples. How many barrels will be required for 1056 bushels?

3. A farmer sold $27\frac{3}{5}$ acres of land for \$1150.00. How much per acre did he receive?

4. It takes 1 man $19\frac{1}{3}$ days to dig a ditch, how long would it take 12 men to dig the same ditch?

5. It requires $43\frac{1}{3}$ yards of cloth to make 5 suits of clothes. How many yards will be required for 17 suits?

6. A pole 28 feet high casts a shadow $64\frac{3}{10}$ feet long. What length of shadow will a pole 15 feet high cast at the same time?

7. If 21 acres of land yield $735\frac{3}{5}$ bushels of oats, how many bushels will 78 acres yield at the same rate?

8. A train goes $184\frac{3}{4}$ miles in 6 hours. How far does it go in $1\frac{1}{3}$ hours?

9. A farmer raised 1078 bushels of wheat from $36\frac{3}{4}$ acres of land. What was the average yield per acre?

10. How many lbs. of butter at $42\frac{2}{3}$ cents per lb. will pay for $34\frac{2}{3}$ lbs. of tea at $37\frac{1}{2}$ cents per lb.?

CHAPTER VIII

DECIMALS

Introductory :

1. Read the number 2,345,678. In this number name the place occupied by each figure in the number.

2. Read the number 11,111. Name the place occupied by each figure in the number.

3. What part of the ten is the unit?

What part of the hundred is the ten?

What part of the thousand is the hundred?

What part of the ten thousand is the thousand?

4. The ten is how many times the unit?

The hundred is how many times the ten?

The thousand is how many times the hundred?

The ten thousand is how many times the thousand?

5. How are the units related to the tens?

How are the tens related to the hundreds?

How are the hundreds related to the thousands?

How are the thousands related to the ten thousands?

6. How are the tens related to the units?

How are the hundreds related to the tens?

How are the thousands related to the hundreds?

How are the ten thousands related to the thousands?

7. If we begin at the units place and move the figure one place to the left, what do we do to the number? Take, for example, 4. If we move it *one* place to the left, we get 40, that is, we multiply 4 by 10.

8. If we begin at the units place and move the figure two places to the left, what do we do to the number? Take, for example, 7. If we move it *two* places to the left, we get 700, that is, we multiply by 100.

9. Moving the figure *three* places to the left multiplies the number by 1000. Moving the figure *four* places to the left multiplies the number by 10,000.

10. Let us take the number 60,000. If we move the 6 *one* place to the right, we get 6000. We have divided by 10.

11. Let us move the 6 *two* places to the right, we have 600. We have divided by 100.

12. If we move the figure *three* places to the right, we divide by 1000. If we move the figure *four* places to the right, we divide by 10,000.

The *ten* is ten times the unit.

The *hundred* is ten times the ten and 100 times the unit.

The *thousand* is 10 times the hundred, 100 times the ten, and 1000 times the unit.

The *ten thousand* is ten times the thousand, 100 times the hundred, 1000 times the ten, and 10,000 times the unit.

10 is 10 times the unit.

100 is 100 times the unit.

1000 is 1000 times the unit.

10,000 is 10,000 times the unit.

The unit is one-tenth of the ten.

The unit is one-hundredth of the hundred; the ten is one-tenth of the hundred.

The unit is one-thousandth of the thousand; the ten is one-hundredth of the thousand; the hundred is one-tenth of the thousand.

The unit is one-ten-thousandth of the ten thousand; the ten is one-thousandth of the ten thousand; the hundred is one-hundredth of the ten thousand; and the thousand is one-tenth of the ten thousand.

By writing a figure one place to the right, we take one-tenth of the number. For example, 5 is $\frac{1}{10}$ of 50.

By writing a figure two places to the right, we take one-hundredth of the number. For example, 5 is $\frac{1}{100}$ of 500.

By writing a figure three places to the right, we take one-thousandth of the number. For example, 5 is $\frac{1}{1000}$ of 5000.

By writing a figure four places to the right, we take one-ten-thousandth of the number. For example, 5 is $\frac{1}{10000}$ of 50,000.

Read the following :

\$5.65	\$235.75	\$65.25	\$4756.15
\$1.50	\$1.25	\$1.10	\$1.40

In these numbers we notice that the cents are written with the dollars, but we use a dot to separate the cents and the dollars.

We write 10 cents	\$.10	25 cents	\$.25
5 cents	\$.05	20 cents	\$.20
50 cents	\$.50	70 cents	\$.70

10 cents is one-tenth of a dollar and is written \$.10.

1 cent is one-hundredth of a dollar and is written \$.01.

30 cents is three-tenths of a dollar and is written \$.30.

7 cents is seven-hundredths of a dollar and is written \$.07.

Read the fractions $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, $\frac{1}{10000}$.

These fractions stand for parts of one or the unit.

If we write down the unit 1, we may write down one-tenth of this by writing it one place to the right of the unit.

Thus :

UNIT	ONE-TENTH
1	$\frac{1}{10}$

We may write down one-hundredth by moving two places to the right of the unit.

Thus :

UNIT	TENTH	HUNDREDTH
1	0	1

In the same way we may write down the thousandth and the ten-thousandth.

Thus :

UNIT	TENTH	HUNDREDTH	THOUSANDTH	TEN-THOUSANDTH
1	0	0	1	1

If, then, we have to the right of the unit place the tenth, hundredth, thousandth, ten-thousandth, and other places, we may write down in this form fractions having 10, 100, 1000, 10,000, etc. as denominators.

Example :

Write down $46\frac{7}{10}$, $8\frac{56}{100}$, $23\frac{562}{1000}$, $75\frac{39}{10,000}$.

HUNDREDS	TENS	UNITS	TENTHS	HUNDREDTHS	THOUSANDTHS	TEN-THOUSANDTHS
	4	6	7			
		8	5	6		
	2	3	5	6	2	
	7	5	0	0	3	9

We see, therefore, that we may write *fractions having as denominators 10 or a power of 10* by using the same system as for whole numbers but we write the fractional part to the right of the units. In order that we may not have to write out the names of the fractional places after the units, we place a small dot at the right side of the units to indicate the units place ; thus to write 3 units we write 3.

This small dot placed after the units indicates the units place and shows where the fractional part of the number begins.

We write $\frac{6}{10}$ thus 0.6.

$\frac{7}{100}$ thus 0.07.

$\frac{36}{100}$ thus 0.36.

$\frac{763}{1000}$ thus 0.763.

There being 0 units we place 0 in the units place.

The following chart shows the place value of figures in integers and decimals :

9	8	7	6	5	0	5	6	7	8	9
hundred-thousands	ten-thousands	thousands	hundreds	tens	units	tenths	hundredths	thousandths	ten-thousandths	hundred-thousandths

The units place should be regarded as the central place, and the decimal point is used to indicate the units position. The integers or whole numbers are written to the left of the units, and the fractional parts or decimals are written to the right of the units. By reference to the chart we notice the following symmetry :

One place to the left of units is tens ; one place to the right is tenths.

Two places to the left of units is hundreds ; two places to the right is hundredths.

Three places to the left of units is thousands ; three places to the right is thousandths.

Note. — The integral part of the whole number ends in *s* ; the fractional part of the decimal ends in *ths*. For example, tens, tenths ; hundreds, hundredths ; thousands, thousandths.

In reading decimal fractions to the right of the decimal

point, we read them as whole numbers and give them the name of the place of the last figure.

For example: Read 0.6 ; 0.78 ; 0.06 ; 0.034 ; 0.008.

0.6 is read **six-tenths**.

0.78 is read **seventy-eight hundredths**.

0.06 is read **six-hundredths**.

0.034 is read **thirty-four thousandths**.

0.008 is read **eight thousandths**.

In writing decimals it is not necessary always to write the 0 in the units ; it is understood that there are 0 units.

In reading a number made up of an integral and a decimal part, we usually separate the fractional part by using the word *and*.

For example: 456.0563 is read, four hundred fifty-six *and* five hundred sixty-three ten-thousandths.

Note. — We may have decimal fractions of the hundred-thousandth, millionth, ten-millionth, hundred-millionth, etc. order. It is not usual to use the decimal fraction much beyond the 4th place or the ten-thousandths order.

Reading and Writing Decimals

Examples:

1. Read the decimal .563. The name of the order of the right-hand figure is thousandths. The decimal is read five hundred sixty-three *thousandths*.

2. Read the decimal .00563. The name of the order of the right-hand figure is hundred-thousandths. The decimal is read five hundred sixty-three *hundred-thousandths*.

3. Read 53.078. The name of the order of the right-hand figure of the decimal is thousandths. Read the

whole number and separate the decimal part with the word *and*. The number is read thus: fifty-three *and* seventy-eight *thousandths*.

EXERCISE

Read the following numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	.05	.345	.008	.137	.0563
2.	.456	.2006	.0705	.0063	.345
3.	.0007	.0570	.835	.89	.506
4.	.5604	.6703	.00006	.7895	.0453
5.	.0275	.8604	.67	.085	.08956
6.	56.087	876.9	34.0056	457.98	458.063
7.	3456.87	45.078	2367.08	67.7805	543.0085
8.	19.0006	567.43	32.008	657.0965	17.023
9.	9.006	700.0007	530.032	80.007	75.006
10.	10.007	50.006	70.0008	600.56	85.0085

EXERCISE

Write all the numbers given above from dictation.

NOTE TO THE TEACHER. — The teacher should read aloud the numbers given in the exercise above and have the pupils write down the notation.

EXERCISE

Write the following numbers :

1. Three and twenty-seven thousandths.
2. Five hundred forty-six and two hundred : nine ten-thousandths.
3. Six hundred and fifty-four millionths.
4. Seventeen and eight hundred-thousandths.

5. Six thousand two hundred thirty-nine and seven hundred three thousandths.
6. Nineteen and four ten-thousandths.
7. Ten and ten-thousandths.
8. Four hundred eighteen and seventeen hundredths.
9. Eighty-six and three thousandths.
10. Eight hundred and thirty-six hundred-thousandths.

EXERCISE

Arrange the following decimal fractions in order of magnitude, the greater fraction being written first :

✓ 1. .0823	.12	.998	.011989	.058	
2. .754	.09985	.8	.09598	.7999	
3. .45689	.05	.4985	.467	.4953	
4. .95685	.09856	.8	.95	.9	.00005
5. .495	.0959	.5	.4995	.075	.4998

Reduction of Decimals to Common Fractions

Introductory :

Express .7 as a common fraction. *Ans.* $\frac{7}{10}$.

Express .35 as a common fraction. *Ans.* $\frac{35}{100}$, and reducing to its lowest terms we have $\frac{7}{20}$.

Reduce .045 to a common fraction.

.045 is the same as $\frac{45}{1000}$, which may be reduced to its lowest terms, $\frac{9}{200}$.

EXERCISE

Reduce the following decimals to common fractions in their lowest terms :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1.	0.08	.85	.625	.0425	.225
2.	.005	.5625	.6875	.3725	.0425
3.	.725	.9375	.0875	.12	.480

Reduction of Common Fractions to Decimal Fractions

*Example:*Reduce $\frac{5}{8}$ to a decimal fraction. $\frac{5}{8}$ indicates the division of 5 by 8.

5 units are not divisible by 8, but we may reduce the units to tenths, obtaining 50 tenths.

50 tenths divided by 8 will give us 6 tenths and 2 tenths over.

We may reduce the 2 tenths to hundredths, obtaining 20 hundredths.

20 hundredths divided by 8 will give us 2 hundredths and 4 hundredths over.

We may reduce the 4 hundredths remainder to thousandths, obtaining 40 thousandths.

40 thousandths divided by 8 will give 5 thousandths.

Writing down our quotients we have: 6 tenths, 2 hundredths, 5 thousandths, or .625.

The work may be shortened thus:

$$\begin{array}{r} 0.625 \\ 8 \overline{)5.000} \end{array}$$

Rule. -- To reduce a common fraction to a decimal fraction, place the decimal point to the right of the numerator, annex zeros, and divide by the denominator of the fraction, placing the decimal point in the quotient.

*Example:*Reduce $\frac{5}{6}$ to a decimal fraction.

$$\begin{array}{r} .833 \\ 6 \overline{)5.000} \end{array} \quad \begin{array}{l} \\ \\ 2 \text{ remainder} \end{array}$$

In this case the division is not exact. The division is usually carried out to 3 or 4 places only, and the remainder is neglected.

EXERCISE

Reduce the following common fractions to decimal fractions. Where necessary carry the decimal fraction to *four* places.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1. $\frac{3}{4}$	$\frac{5}{8}$	$\frac{3}{5}$	$\frac{16}{25}$	$\frac{9}{16}$
2. $\frac{35}{50}$	$\frac{11}{32}$	$\frac{48}{64}$	$\frac{15}{50}$	$\frac{19}{40}$
3. $\frac{4}{7}$	$\frac{5}{9}$	$\frac{10}{11}$	$\frac{7}{15}$	$\frac{7}{12}$
4. $\frac{24}{25}$	$\frac{12}{14}$	$\frac{17}{45}$	$\frac{25}{36}$	$\frac{5}{64}$
5. $\frac{51}{32}$	$\frac{45}{25}$	$\frac{15}{8}$	$\frac{24}{16}$	$\frac{87}{50}$
6. $\frac{74}{38}$	$\frac{35}{27}$	$\frac{27}{35}$	$\frac{42}{40}$	$\frac{97}{35}$
7. $\frac{39}{28}$	$\frac{65}{35}$	$\frac{42}{16}$	$\frac{48}{18}$	$\frac{88}{33}$
8. $\frac{245}{35}$	$\frac{178}{56}$	$\frac{356}{37}$	$\frac{657}{397}$	$\frac{835}{169}$

Addition of Decimals

Introductory :

Add 457, 6543, 24, 12,345.

To add these we write them down thus :

457
6543
24
12345

19369

In adding, we first add the units, then tens, and so on until the sum is completed.

Example :

Add 34.67, 236.08, 5.007, 64.8.

34.67
236.08
5.007
64.8

340.557

Arrange these under each other, placing units under the units, tens under tens, etc., tenths under tenths, hundredths under hundredths, etc. Add figures of the same order ; put down the sum, and carry to the next higher order. Begin at the right-hand column of the addition.

EXERCISE

Add :

1.	0.764 7.009 <u>43.06</u>	2.	34.56 8.007 <u>76.05</u>	3.	567.09 64.985 46.7 <u>456.006</u>	4.	435.887 76.09 569.007 <u>56.8</u>
5.	567.08 79.4 457.003 <u>8.978</u>	6.	23.789 5670.08 78.8 <u>4605.67</u>	7.	789.006 64.75 5763.9 <u>567.08</u>	8.	57.4 7439.008 369.84 <u>69.073</u>
9.	3005.67 674.009 7.8 <u>503.67</u>	10.	69.804 604.79 47.053 <u>4598.8</u>				

EXERCISE

Copy and add, arranging the work in columns :

1. 7.49, 346.89, 17.23678, 37.654, 560.895, 567.936, 29.57.
2. 356.78, 89.0874, 3.987, 896.564, 56.984, 326.789, 7.89.
3. 49.327, 0.458, 8317.05, 341.875, 32.4962, 764.983, 18.76.
4. 560.379, 0.45687, 378.834, 54.369, 298.763, 39.45, 0.987.
5. 367.89, 0.985, 7.836, 456.93, 39.749, 543.749, 0.987.
6. \$38.95, \$345.67, \$785.94, \$56.78, \$93.67, \$327.87.
7. \$456.87, \$78.93, \$89.65, \$78.35, \$684.56, \$97.68.
8. \$356.97, \$56.84, \$467.93, \$367.04, \$273.67, \$56.89.
9. \$85.69, \$793.50, \$239.76, \$58.95, \$349.78, \$38.72.
10. \$456.78, \$534.95, \$675.48, \$347.89, \$479.06, \$56.84.

11. 657.078, 56.895, 543.78, 567.984, 786.543, 789.67.
 12. 456.67, 893.75, 678.789, 236.54, 78.93, 873.456.
 13. 456.935, 67.089, 0.786, 3.6789, 17.9567, 0.3798, 67.
 14. 896.45, 546.38, 0.987, 54.876, 19.87, 0.896, 47.865.

15.	657.987	16.	56.098	17.	34,789.09
	4,678.047		5679.876		7,045.736
	798.86		34.07		684.74
	98,654.367		7489.245		6,783.085
	<u>69.84</u>		<u>567.097</u>		<u>67.87</u>

18.	7897.098	19.	.608935	20.	.80975
	783.85		459.0983		6.78959
	573.078		560.98		49.089
	67.9		9.72458		8.45673
	<u>3.459</u>		<u>67.098</u>		<u>56.74</u>

21.	.57608	22.	.78342
	34.02467		8.0976
	578.75		459.0652
	94.3286		73.265
	<u>9.45</u>		<u>6.35</u>

Write in columns, and add :

23. 375.89, 45.098, 5.675, 5489.065, 34.658, 432.8.
 24. 386.45, 7.895, .0985, 45.98, 234.075, 65.9856.
 25. 36.892, 789.45, 4.785, 25.765, 9.98, 345.9706.
 26. 9.65, 0.786, 296.4, 75.368, 39.67, 54.097, 8.055.
 27. 376.7, 97.76, 3.8764, 674, 27.864, 0.764, 45.098.
 28. 2.345, .0015, 6.0805, 287.6754, .609, 467, 34.098.
 29. 9.1235, 654.098, 567.45, .0985, 5689, 2.0056, 56.78.
 30. 98.84, 9.465, 8.07, 19.765, 83.486, 7.985, 345, .89.

NOTE TO THE TEACHER. — Dictate the following examples in addition of decimals :

1.	.275	2.	.4	3.	46.78	4.	543.09
	436.8		675.075		83.089		67.765
	56.75		6.875		538.07		8.85
	<u>8.034</u>		<u>67.75</u>		<u>56.7</u>		<u>800.085</u>
5.	56.075	6.	54.784	7.	67.098	8.	46.987
	349.8		96.4679		8.985		7.093
	17.56		347.98		4563.78		458.983
	<u>75.056</u>		<u>85.75</u>		<u>78.45</u>		<u>9.753</u>
9.	0.09856	10.	78.953				
	475.78		679.56				
	29.39		85.799				
	<u>5.798</u>		<u>479.326</u>				

EXERCISE

1. A man went on a journey travelling as follows : From Brandon to Regina, a distance of 223.7 miles ; from Regina to Saskatoon, a distance of 181.3 miles ; from Saskatoon to Brandon directly, a distance of 397.6 miles. How far did he travel altogether ?

2. A party took an automobile trip and travelled the following distances : first day, 98.75 miles ; second day, 135.8 miles ; third day, 235.45 miles ; fourth day, 138.56 miles. How far did they travel in the four days ?

3. On my summer vacation I left Calgary and went to Banff. From Banff I went to Vancouver, from Vancouver to Victoria, from Victoria back to Vancouver, then back to Banff, and returned to Calgary. If the distance from Calgary to Banff is 81.9 miles, from Banff to Vancouver 559.9 miles and from Vancouver to Victoria 78.8 miles, how

far did I travel on the entire return trip to Victoria from Calgary?

4. At Vancouver in 1912 the rainfall for the year was as follows: January, 7.64 inches; February, 6.25 inches; March, 0.89 inches; April, 3.92 inches; May, 2.35 inches; June, 2.28 inches; July, 1.54 inches; August, 5.86 inches; September, 2.84 inches; October, 4.64 inches; November, 9.21 inches; December, 8.70 inches. Find the total rainfall for the year.

5. At Moose Jaw the rain and snow fall for the year 1912 was as follows: January, .25 inches; February, .017 inches; March, .14 inches; April, .41 inches; May, 3.78 inches; June, 1.72 inches; July, 2.86 inches; August, 2.15 inches; September, 1.60 inches; October, .33 inches; November, .06 inches; December, .56 inches. Find the total precipitation for the year in inches.

6. A farmer threshed the following number of bushels of grain from 6 fields: first field, 487.56 bushels; second field 534.05 bushels; third field, 453.85 bushels; fourth field 395.65 bushels; fifth field, 658.76 bushels; sixth field, 567.84 bushels. How much grain did he thresh from the six fields?

7. I had a field of alfalfa. From the first cutting I secured 18.45 tons, from the second cutting 13.75 tons, and from the third 8.65 tons. How many tons did I get from the three cuttings?

8. A man bought a farm made up of the following parcels of land: 456.78 acres, 235.8 acres, 164.5 acres, 476.55 acres, and 375.85 acres. Find the total number of acres in the farm.

9. A coal dealer made the following sales of coal in one day: 7.5 tons, 24.56 tons, 56.85 tons, 16.74 tons, 26.72 tons, 15.64 tons, and 45.75 tons. Find the total amount of coal sold in the day.

10. At the Manitoba Agricultural College in a dairy test covering one week an Ayreshire cow gave the following daily quantities of milk : Sunday, 31.95 lbs. ; Monday, 28.78 lbs. ; Tuesday, 36.35 lbs. ; Wednesday, 29.86 lbs. ; Thursday, 30.72 lbs. ; Friday, 28.45 lbs. ; Saturday, 29.25 lbs. Find the total weekly supply of milk from this cow.

Subtraction of Decimals

Example: From 45.43 take 7.684.

45.430 Write down the numbers as in ordinary subtraction,
 7.684 taking care that the decimal points are in the same
 37.746 column and that figures of the same order are placed
 under each other, units under units, etc.

Begin at the right-hand figure.

Since the first figure in the subtrahend is thousandths, annex a zero to the minuend making a thousandth place in it. Subtract as with whole numbers, placing the decimal point of the answer under the decimal points above.

EXERCISE

Subtract, checking the answers by addition :

- | | | | |
|---------------------------------------|---------------------------------------|---------------------------------------|--|
| 1. 76.083
37.594
<u> </u> | 2. 456.09
94.075
<u> </u> | 3. 34.0347
7.0568
<u> </u> | 4. 2.0432
0.78
<u> </u> |
| 5. 67.0052
8.8964
<u> </u> | 6. 38.94
7.895
<u> </u> | 7. 57.4
9.6578
<u> </u> | 8. 53.79
8.693
<u> </u> |
| 9. 65.2
17.562
<u> </u> | 10. 37.3
34.673
<u> </u> | 11. 2.0004
1.2357
<u> </u> | 12. 24.36
19.5804
<u> </u> |
| 13. .9357
.76883
<u> </u> | 14. 6.0002
4.0437
<u> </u> | 15. 56.
4.478
<u> </u> | 16. 854.36
394.472
<u> </u> |
| 17. 6.00785
.545
<u> </u> | 18. 76.592
9.583
<u> </u> | 19. 453.
367.4503
<u> </u> | 20. 56.294
8.758
<u> </u> |

NOTE TO THE TEACHER. -- Dictate the following examples in subtraction :

EXERCISE

- | | | | | |
|---------------|---------------|----------------|---------------|---------------|
| 1. 5. | 2. 1.047 | 3. 345.06 | 4. 38.0032 | 5. 78.56 |
| <u>3.0345</u> | <u>.9025</u> | <u>247.375</u> | <u>9.2345</u> | <u>9.078</u> |
| 6. 3.78 | 7. 45.8 | 8. 6.083 | 9. 8.0003 | 10. 35.6 |
| <u>.0046</u> | <u>29.095</u> | <u>4.675</u> | <u>.0765</u> | <u>29.753</u> |

EXERCISE

1. The thermometer at 8 A.M. registered 46.85 degrees ; at 3 P.M. it registered 73.25 degrees. Find the difference in temperature.

2. A coal dealer has a bin of coal containing 45.8 tons. He sells 18.25 tons from it. How much remains in the bin?

3. For the year 1912 the rainfall at Victoria, B. C., was 29.53 inches ; at Calgary during the same year the rainfall was 18.80 inches. Find the difference in rainfall.

4. During the year 1913 the snowfall at Edmonton was 47.8 inches ; in Ottawa during the same year the snowfall was 88.1 inches. Find the difference in snowfall.

5. In 1911 the rainfall for the year at Lethbridge was 17.23 inches ; during the same year the rainfall at Regina was 14.56 inches. Find the difference in rainfall.

6. The distance from Winnipeg to Vancouver is 1474.2 miles ; the distance from Calgary to Vancouver is 641.8 miles. Find the distance between Winnipeg and Calgary.

7. The distance from Winnipeg to Edmonton by way of Saskatoon is 848.5 miles ; from Saskatoon to Edmonton it is 368.7 miles. What is the distance from Winnipeg to Saskatoon ?

8. From Montreal to Vancouver the distance is 2885.8 miles; from Winnipeg to Vancouver the distance is 1474.2 miles. What is the distance between Montreal and Winnipeg?

9. At the Ontario Agricultural College a test was made of the milk from Ayrshire, Jersey, and Holstein cows. For every 100 lbs. of milk the following number of lbs. of butter fat were secured: Jersey, 5.003 lbs.; Ayrshire, 3.55 lbs.; Holstein, 3.79 lbs. Find the difference in the amount of butter fat of every 100 lbs. of milk from each type of cow.

10. In 100 lbs. of crushed oats there are 78.9 lbs. of digestible animal food; in 100 lbs. of wheat bran there are 54.1 lbs. of digestible animal food. How much more food is there in 100 lbs. of crushed oats than in the same weight of wheat bran?

EXERCISE

1. Simplify $76.5 - 38.43 + 78.23 + 56.34 - 8.045 - 76.54 + 35.06 - 75.54$.

2. Simplify $345.67 - 65.095 + 45.35 - 6.056 + 675.055 - 34.65 - 7.89 + 54.375$.

3. Simplify $53 - 35.56 + 18.0875 + 245.065 - 6.783 + 54.785 - 0.985 + 6.783$.

4. Simplify $0.008 - 14.56 + 75.893 - 0.0765 - 7.575 - 23.5473 + 56.952 - 0.9$.

5. Simplify $45.673 - 9.085 + 0.854 + 46.974 + 345.095 - 6.7532 - 65.0085$.

6. A man owned a farm containing the following parcels of land: 345.65 acres, 256.85 acres, 158.65 acres, and 450.75 acres. From this farm he sold the following parcels: 185.65 acres, 245.5 acres, and 350.75 acres. How much land did he have left in the farm?

7. One farmer has 45.65 tons of hay for sale; another farmer who has already sold 37.56 tons has left 28.74 tons to sell. How much hay had both farmers to sell?

8. The Provincial Government has 98.75 miles of road-way to make. It lets contracts for the following pieces of the road: 8.5 miles, 25.56 miles, 17.85 miles, and 36.75 miles. The remainder is built by the Government. How many miles will the Government build?

9. A vessel is going from Sarnia to Montreal and must pass through the following canals: Welland Canal, 26.75 miles long; Murray Canal, 5.167 miles long; Galops, 7.125 miles long; Rapide Plat, 3.5 miles long; Farrens Point, 1 mile long; Cornwall, 11 miles long; Soulanges, 14 miles long; and Lachine, 8.5 miles long. Through how many miles of canals does the vessel pass?

10. The precipitation at Calgary during the year 1911 was as follows: January, .44 inches; February, .56 inches; March, 1.04 inches; April, 1.06 inches; May, 5.03 inches; June, 2.63 inches; July, 2.17 inches; August, 4.36 inches; September, .89 inches; October, .51 inches; November, .61 inches; December, .17 inches.

During the same year the precipitation at Edmonton was as follows: January, 1.18 inches; February, .31 inches; March, .39 inches; April, .45 inches; May, 1.95 inches; June, 3.8 inches; July, 5.83 inches; August, 4.49 inches; September, .98 inches; October, .51 inches; November, .52 inches; December, .26 inches. Find the difference in precipitation between Edmonton and Calgary for this year.

Multiplication of Decimals

Introductory.

Examples:

1. Multiply 436 by .6.
2. Multiply 546 by 4.03.
3. Multiply 65.4 by 3.8.
4. Multiply .045 by .073.

1. Multiply 436 by .6.

$$436 \times .6 = 436 \times \frac{6}{10} = \frac{2616}{10} = 261\frac{6}{10} = 261.6$$

$$\begin{array}{r} 436 \\ \times .6 \\ \hline 261.6 \end{array}$$

2. Multiply 546 by 4.03.

$$546 \times 4.03 = 546 \times 4\frac{3}{100} = 546 \times \frac{403}{100}$$

$$= \frac{220038}{100} = 2200\frac{38}{100} = 2200.38$$

$$\begin{array}{r} 546 \\ \times 4.03 \\ \hline 1638 \\ 21840 \\ \hline 2200.38 \end{array}$$

3. Multiply 65.4 by 3.8.

$$65.4 \times 3.8 = 65\frac{4}{10} \times 3\frac{8}{10} = \frac{654}{10} \times \frac{38}{10}$$

$$= \frac{24852}{100} = 248\frac{52}{100} = 248.52$$

$$\begin{array}{r} 65.4 \\ \times 3.8 \\ \hline 5232 \\ 19620 \\ \hline 248.52 \end{array}$$

4. Multiply .045 by .073.

$$.045 \times .073 = \frac{45}{1000} \times \frac{73}{1000} = \frac{3285}{1000000} \\ = .003285$$

$$\begin{array}{r} .045 \\ .073 \\ \hline 135 \\ 315 \\ \hline .003285 \end{array}$$

Study carefully the foregoing examples.

Compare the product in each case. We find that it is made up by multiplying the numbers together as in ordinary multiplication. The number of decimal places in the product is equal to the sum of the number of places in the multiplier and the multiplicand.

Rule. — Multiply as in the case of whole numbers. Mark off as many places of decimals in the product as there are in the multiplicand and multiplier together.

ORAL EXERCISE

A. Without multiplying, tell the number of decimal places there will be in each of the following products:

- | | | |
|------------------|-------------------|-------------------|
| 1. 654 by .4 | 2. 4573 by .74 | 3. 6742 by 3.4 |
| 4. 3.5 by 6.7 | 5. 4.5 by .06 | 6. 34.07 by 2.06 |
| 7. .234 by 56 | 8. .0893 by 3.4 | 9. 34.07 by 4.003 |
| 10. .0089 by 7.4 | 11. 6.98 by 65.02 | 12. 74.2 by .006 |

B. Find the products of each of the above examples.

EXERCISE

Multiply the following:

- | | | | | |
|------------|------------|------------|------------|-------------|
| 1. 0.743 | 2. 8.06 | 3. 347.3 | 4. 2.87 | 5. 65.072 |
| <u>.36</u> | <u>.07</u> | <u>.64</u> | <u>.56</u> | <u>7.03</u> |

$$\begin{array}{r} .039 \\ \underline{6.8} \end{array}$$

ARITHMETIC

6. $\begin{array}{r} .039 \\ \underline{6.8} \end{array}$	7. $\begin{array}{r} .764 \\ \underline{43.09} \end{array}$	8. $\begin{array}{r} 6.007 \\ \underline{.78} \end{array}$	9. $\begin{array}{r} 845.04 \\ \underline{.93} \end{array}$	10. $\begin{array}{r} 54.006 \\ \underline{.706} \end{array}$
11. $\begin{array}{r} .734 \\ \underline{7.034} \end{array}$	12. $\begin{array}{r} 74.9 \\ \underline{.806} \end{array}$	13. $\begin{array}{r} 85.05 \\ \underline{3.57} \end{array}$	14. $\begin{array}{r} 34.86 \\ \underline{2.73} \end{array}$	15. $\begin{array}{r} .0874 \\ \underline{.0073} \end{array}$
16. $\begin{array}{r} .324 \\ \underline{.0063} \end{array}$	17. $\begin{array}{r} 6.87 \\ \underline{37.06} \end{array}$	18. $\begin{array}{r} 23.07 \\ \underline{7.0003} \end{array}$	19. $\begin{array}{r} 80.563 \\ \underline{.0234} \end{array}$	20. $\begin{array}{r} 4.372 \\ \underline{5.073} \end{array}$

EXERCISE

Multiply :

- | | | |
|-------------------|--------------------|--------------------|
| 1. 456.78 by 4.36 | 6. .34 by 7.093 | 11. 63.4 by 7.09 |
| 2. .0894 by 35.08 | 7. 37.006 by 4.7 | 12. 2345 by 14.67 |
| 3. 64.78 by .087 | 8. 75.083 by .0327 | 13. 8.043 by 3.047 |
| 4. 56.410 by .763 | 9. 89.003 by .78 | 14. 8.346 by .0083 |
| 5. 7.412 by .0098 | 10. 6.73 by 8.0406 | 15. 7.265 by .189 |

EXERCISE

Multiply :

- | | | |
|------------------|---------------------|--------------------|
| 1. 7.6 by 78.03 | 6. 74.003 by 32.007 | 11. 34.008 by 540 |
| 2. .00067 by 350 | 7. .00783 by 600 | 12. 7.00839 by 300 |
| 3. 56.009 by 320 | 8. .0984 by 20,000 | 13. .09083 by 3000 |
| 4. 7.0065 by 400 | 9. 43.083 by 2350 | 14. .34567 by 1000 |
| 5. 49.874 by 345 | 10. .08067 by 5600 | 15. 6.863 by 3.070 |

EXERCISE

1. A ship travels at the rate of 17 knots per hour. How many miles will it go in 36 hours, if a knot is equal to 1.1515 miles?

2. A rectangular field is 35.75 rods long and 24.5 rods wide. How many square rods are there in the field?

3. The circumference of a circle is 3.1416 times the length of its diameter. Find the circumference of the driving wheel of a locomotive which has a diameter of 9.250 feet.

4. What is the weight of the water in a rectangular tank 8 feet long, 4 feet wide, and 4 feet deep, if 1 cubic foot of water weighs 62.5 lbs.?

5. A train is travelling at the rate of 38.75 miles per hour. It runs for 6.25 hours. How far has it travelled?

6. A dairy cow produced in one year 8754 lbs. of milk, which graded 4.37 lbs. butter fat per 100 lbs. of milk. Find the total amount of butter fat produced from the cow in 1 year.

What is the value of the year's butter fat, if the price received for it was 53 cents per lb.?

7. Find the cost of a shipment of goods weighing 8795 lbs. at a freight rate of \$1.79 per cwt.

8. A shipment of farm machinery weighing 16,785 lbs. was sent from Calgary to Peace River by way of Edmonton. The freight rate from Calgary to Edmonton is \$.49 per cwt., and from Edmonton to Peace River is \$.90 per cwt. What was the total cost of the freight?

9. A man cut 258 acres of wheat, which averaged 37.85 bushels per acre. He sold the wheat at \$2.19 per bushel. Find how much he received for his wheat.

10. A man has a herd of 28 dairy cattle. He requires 4.5 tons of ensilage for each animal. How many tons does he require for the herd? The ensilage is sold at \$23.75 per ton. What is the total cost of the ensilage?

Division of Decimals

To divide a decimal by a whole number.

Introductory.

Example: 1. Divide 3468 by 4.

$$\begin{array}{r} 867 \\ 4 \overline{)3468} \end{array}$$

Note. — We place the figure of the quotient above the corresponding figure of the dividend.

2. Divide 34.7620 by 4.

$$\begin{array}{r} 8.6905 \\ 4 \overline{)34.7620} \end{array}$$

Note. — Place the figure of the quotient above the corresponding figure of the dividend. Place the decimal point of the quotient above the decimal point of the dividend. Proceed as in ordinary division.

3. Divide 2356.784 by 8.

$$\begin{array}{r} 294.598 \\ 8 \overline{)2356.784} \end{array}$$

4. Divide .00384 by 8.

$$\begin{array}{r} .00048 \\ 8 \overline{).00384} \\ \underline{.0} \\ 0 \\ \underline{0} \\ 38 \\ \underline{32} \\ 64 \\ \underline{64} \end{array}$$

Note. — The work should be shortened :

$$\begin{array}{r}
 .00048 \\
 8 \overline{) .00384} \\
 \underline{.0032} \\
 64 \\
 \underline{64} \\
 0000
 \end{array}$$

EXERCISE

Divide the following :

- | | | |
|------------------|-----------------|-----------------|
| 1. 24.563 by 7 | 2. 135.426 by 6 | 3. 457.254 by 9 |
| 4. 326.921 by 7 | 5. 2.814 by 14 | 6. 0.0126 by 18 |
| 7. 16.0032 by 16 | 8. 956 by 14 | 9. 12.978 by 21 |

EXERCISE

Divide the following :

- | <i>a</i> | <i>b</i> | <i>c</i> |
|---------------------|------------------|------------------|
| 1. 45.368 by 4 | 454.24 by 8 | 2168.8415 by 7 |
| 2. 683.487 by 9 | 108.46 by 17 | 181.926 by 27 |
| 3. 19891.832 by 38 | 10005.66 by 378 | 2303.859 by 293 |
| 4. 545.5562 by 179 | 19306.452 by 268 | 5990.04 by 56 |
| 5. 0.02337 by 41 | 1.6184 by 34 | 32.7405 by 365 |
| 6. 741.6006 by 806 | 81069.24 by 937 | 3653.874 by 1234 |
| 7. 7590.304 by 772 | 11530.624 by 128 | 429.219 by 567 |
| 8. 0.0159120 by 255 | 364.1750 by 875 | 329.718 by 614 |
| 9. 4.34172 by 746 | 237.5208 by 792 | 0.0466250 by 625 |
| 10. 20.64569 by 403 | 903.2562 by 209 | 968.582 by 359 |

To divide or multiply a number by 10, 100, 1000, or any power of ten :

Multiply .56 by 10. *Ans.* 5.6.

Multiply 0.0567 by 100. *Ans.* 5.67.

Multiply 6.045 by 1000. *Ans.* 6045.

Multiply 2.45 by 1000. *Ans.* 2450.

Note. — A number is multiplied by 10, or by any power of ten, by moving the decimal point as many places to the right as there are zeros in the multiplier, zeros being added to the product where necessary.

Divide 5.6 by 10. *Ans.* 0.56.

Divide 5.67 by 100. *Ans.* 0.0567.

Divide 6045 by 1000. *Ans.* 6.045.

Divide 2450 by 1000. *Ans.* 2.45.

Note. — A number is divided by 10, or by any power of ten, by moving the decimal point as many places to the left as there are zeros in the divisor, adding zeros to the quotient where necessary.

EXERCISE

Divide each of the following examples by 10, 100, and 1000 :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. 38.75	234.7	547.95	46.754
2. 34.57	67.45	43.7885	5.008
3. 45	6.05	0.089	56.05
4. 42.7	60.5	8.097	0.6534
5. 4.27	2.3707	246.9	187.6

EXERCISE

Multiply each of the following examples by 10, 100, 1000 :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. 38.65	546.09	65.856	3.452
2. 0.089	5.6704	732.074	0.0653
3. 42.07	4.035	65.456	1.056
4. .678	3.098	.2345	0.56

ORAL EXERCISE

Read aloud the following numbers :

By what must we multiply each of the following numbers in order to make them whole numbers or integers ?

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1.	34.6	.876	0.056	43.09	6.008	345.04
2.	.0087	56.043	0.805	435.7	5.904	67.006
3.	6.875	568.43	8.093	356.98	0.0006	9.0765
4.	43.678	65.092	567.003	28.06	65.009	.000853
5.	0.00985	0.0305	18.305	327.602	13.050	0.9008

To divide a decimal by a decimal.

Introductory.

1. Divide 4624 by 8. *Quotient, 578.*

Multiply both dividend and divisor by the same numbers, and divide.

Multiplying by 9, we have

41,616 divided by 72. *Quotient, 578.*

Multiplying both dividend and divisor by 10, we have

46,240 divided by 80. *Quotient, 578.*

2. Divide 76,531 by 7. *Quotient, 10,933.*

Multiply both dividend and divisor by the same numbers.

Multiplying by 8, we have

612,248 divided by 56. *Quotient, 10,933.*

Multiplying both dividend and divisor by 10, we have

765,310 divided by 70. *Quotient, 10,933.*

Note. — If we multiply both dividend and divisor by the same number, the value of the quotient remains the same.

Example:

Divide 48.96 by .8.

We have learned how to divide by 8. If then we change the divisor to 8, we may proceed with the division. To change the divisor to 8 we multiply by 10. If the divisor is multiplied by 10, the dividend must be multiplied by the same number in order that the quotient may be the same.

Hence 48.96 divided by .8 is the same as

489.6 divided by 8. *Quotient, 61.2.*

Example:

Divide 51.43 by .37.

Make the divisor a whole number by multiplying by 100. Multiply the dividend by 100. Proceed as in ordinary division.

$$\begin{array}{r}
 139. \\
 37 \overline{)5143} \\
 \underline{37} \\
 144 \\
 \underline{111} \\
 333 \\
 \underline{333} \\
 0
 \end{array}$$

Example:

Divide .07928 by .04.

$$\begin{array}{r}
 1.982 \\
 4 \overline{)7.928} \\
 \underline{4} \\
 39 \\
 \underline{36} \\
 328 \\
 \underline{328} \\
 0
 \end{array}$$

Example:

Divide 36 by .025.

The decimal point is not written at the end of a whole number, but it may be regarded as coming after the units.

We annex zeros to the dividend to make up the number of places, thus :

$$\begin{array}{r}
 36,000 \text{ divided by } 25. \\
 1440 \\
 25 \overline{)36000} \\
 \underline{25} \\
 110 \\
 \underline{100} \\
 100 \\
 \underline{100} \\
 00
 \end{array}$$

Example:

Divide .0005691 by .07.

Multiplying both dividend and divisor by 100, we have

.05691 divided by 7.

$$\begin{array}{r}
 .00813 \\
 7 \overline{).05691}
 \end{array}$$

EXERCISE

Divide :

<i>a</i>	<i>b</i>	<i>c</i>
1. 56.7830 by .5	672.849 by .9	50.9943 by .7
2. 74.8664 by .8	3.81504 by .06	.115395 by .03
3. 13.6967 by .29	2.157248 by .37	.221112 by .037
4. 13.427 by .029	1.78542 by .327	.760608 by .278
5. .77794 by 8.02	89.9964 by 7.02	.1199352 by 77.88
6. 8.236 by .145	1023.82 by 4.97	.5453370 by 1.18
7. .03195 by 7.5	106.72 by .0368	.00455 by 17.5
8. .0113391 by 3.87	18.496 by .512	.03931822 by .967

<i>a</i>	<i>b</i>	<i>c</i>
9. 1.10643 by 0.039	0.0058893 by 0.067	.5214227 by .0893
10. 3294.2808 by 4.37	0.001032152 by 0.0296	312.7194 by 3.78

If the division is not exact, carry out the quotient to 3, 4, or 5 places of decimals.

EXERCISE

Divide the following, correct to *four* places of decimals :

<i>a</i>	<i>b</i>	<i>c</i>
1. 1.6803 by 23.8	19.8734 by 3.56	3.1418 by 27.5
2. 70.887 by 83.5	28 by 5.73	20.25 by 6.75
3. 200 by 2.35	150.345 by 37.8	35 by .0327
4. 73 by .085	234 by .035	500 by .045
5. 48.591 by 96	2.56 by .0032	8.4126 by 63.5
6. 3.1 by .0025	.0056 by 1.7	.0774 by 37.5
7. 203 by 0.019	406.8 by 0.185	1.0236 by 7.8
8. 15.78 by 2.039	0.0876 by 2.53	0.873 by .0739
9. 34.78 by 3.79	35 by .0893	245.9853 by 374
10. .0234568 by 7.85	9 by 0.00935	47 by 0.0763

EXERCISE

1. The rainfall for 12 months at Winnipeg in 1915 was 15.78 inches. What was the average monthly rainfall?

2. The annual precipitation at Lethbridge for the years 1909–1913 was as follows :

1909	11.69 inches	1910	7.98 inches
1911	22.11 inches	1912	14.20 inches
1913	14.75 inches		

Find the average annual precipitation for this period.

3. A man took a railway journey. His railway fare was \$32.98. If the railway charges 3.45 cents per mile, what was the length of the journey?

4. At a dairy test at the University of Alberta, a Holstein cow gave in the year 21,030 lbs. of milk which produced 809 lbs. of butter fat. How many lbs. of butter fat does this test per 100 lbs. of milk?

5. A herd of dairy cows tested the following amount of butter fat per 100 lbs. of milk during the year's test :

COW	LBS. OF BUTTER FAT PER 100 LBS. OF MILK	COW	LBS. OF BUTTER FAT PER 100 LBS. OF MILK
No. 1	3.63	No. 6	3.55
No. 2	3.75	No. 7	3.92
No. 3	3.79	No. 8	5.03
No. 4	3.94	No. 9	5.22
No. 5	3.65	No. 10	4.8

Find the average amount of butter fat per 100 lbs. of milk for the herd.

6. A man bought wheat at \$1.78 per bushel, investing \$4690.30. How many bushels of wheat did he buy?

7. I invested \$3386.25 in oats which cost me 87.5 cents per bushel. How many bushels did I buy?

8. An aviator flew between two places 352 miles apart. His total time in the air was 2.75 hours. What was his average speed per hour?

9. In 1917 the cattle in the four Western Provinces were valued at \$242,929,000.00. The average value of 1 animal was placed at \$69.25. How many head of cattle were in the provinces?

10. A farmer sold $.125$ of his wheat crop in November, and in December he sold $.585$ of the crop. At the end of the year he had 24,679 bushels left. Find the total amount of his crop.

11. A man raised 345.876 bushels of wheat from 20.5 acres of land. At the same rate what should be the amount of his crop off 245 acres?

12. Find the cost of fencing a rectangular field 63.75 rods long and 54.5 rods wide at \$2.35 per rod.

CHAPTER IX

DENOMINATE NUMBERS AND APPLICATIONS

What unit of measure does the grocer use in measuring the sugar he sells? What unit of measure does the dry goods merchant use in selling cloth? What unit of measure does a farmer use in measuring the amount of grain he has? What unit of measure does the dairyman use in selling milk? What unit of measure do you use in finding the amount of money you have?

What is the unit, and how often is the unit repeated in 8 feet? in 4 ounces? in 6 dozen? in 20 cents? in 3 gallons? in 2 hours?

Measuring a quantity is the process of finding how many times the fixed unit of that quantity is contained in it.

The concrete numbers, 8 feet, 4 ounces, etc., in which the unit of measure has a fixed value established by law or custom, are called *denominate numbers*.

A denominate number composed of units of only one denomination, as 2 feet, 4 tons, 5 hours, is called a *simple denominate number*.

A denominate number containing units of two or more denominations each of which may be expressed in terms of the other, as 3 feet 4 inches, 5 hours 30 minutes, 2 gallons 3 quarts, is called a *compound denominate number*.

Canadian Money

Canadian money is the legal currency of the Dominion of Canada. It consists of *dollars*, *cents*, and *mills*.

The *dollar* is the unit and is denoted by the symbol \$.

$\begin{aligned} 10 \text{ mills} &= 1 \text{ cent} \\ 100 \text{ cents} &= \$1 \end{aligned}$
--

In writing a sum of money dollars are separated from cents by a *point*. Thus \$6.75 is read six dollars and seventy-five cents. Any number of cents less than ten, when written with dollars, occupies the second place to the right of the *point*, and the first place to the right of the point is occupied by a *zero*. Thus 4 dollars and five cents is written \$4.05. The mill is one-tenth of a cent and is written one place to the right of the cents. Thus, \$3.775 is read 3 dollars, 77 cents, and 5 mills.

The present silver coins of the Dominion are the fifty-cent piece, the twenty-five cent piece, the ten-cent piece, and the five-cent piece. The one-cent piece is made of copper. The mill is not coined and is used only in certain computations.

ORAL EXERCISE

1. How many cents are there in \$3.16? in \$4.25? in \$2.05? in \$9.50? in \$10.05?
2. How many cents are equal to a five-dollar bill? to a dollar bill and 25 cents? to a ten-dollar bill and 10 cents? to a two-dollar bill and 5 cents?
3. How many cents are there in one dollar and a half? in one dollar and a quarter? in five dollars and a half?

4. How many dollars and cents are there in 375 cents? in 525 cents? in 910 cents? in 1025 cents? in 605 cents?

5. How many two-dollar bills are equal to 600 cents? to 800 cents? to 1000 cents?

6. How many ten-cent pieces are there in \$2? in \$3? in \$5?

7. How many cents are equal to 3 ten-dollar bills? to two five-dollar bills? to 4 ten-dollar bills?

8. How many five-cent pieces are there in \$2? in one dollar and a half? in two dollars and a quarter?

Reduction.

The process of changing the units of one denomination to units of another denomination of a denominate number without changing its value is called *reduction*.

Which is the unit of greater value, \$1 or 1 cent? Which is the unit of greater weight, 1 pound or 1 ounce? Which is the unit of greater length, 1 foot or 1 yard?

Changing a given unit to a smaller unit is called *reduction to a lower denomination*, or *reduction descending*.

Changing a given unit to a larger unit is called *reduction to a higher denomination*, or *reduction ascending*.

EXERCISE

Reduce to cents, and read :

1. \$5; \$7.36; \$17.04.
2. \$29.18; \$414.36; \$200.09.
3. \$361.07; \$500.75; \$1000.10.
4. \$11,875.63; \$3647.29; \$76,841.06.
5. \$20,063.07; \$10,101.01; \$20,025.05.

Reduce to dollars and cents, and read :

6. 368 cents ; 700 cents ; 1236 cents.
7. 3605 cents ; 7008 cents ; 50,205 cents.
8. 54,168 cents ; 400,709 cents ; 684,007 cents.
9. 300,041 cents ; 280,014 cents ; 340,001 cents.

British, or Sterling Money

4 farthings (far.)	= 1 penny (1d.)	
12 pence	= 1 shilling (1s.)	$24\frac{1}{3}$
20 shillings	= 1 pound (£1)	$= 1 \text{ } \frac{1}{10} \text{ } \text{dollar}$
	$= \$ \frac{4 \frac{1}{3}}{15} = \$ \frac{23}{15} = 240 \text{ d.}$	

£1 sterling = \$4.86 $\frac{2}{3}$; 1s. = 24 $\frac{1}{3}$ cents; 21s. = 1 guinea;
5s. = a crown

ORAL EXERCISE

1. How many far. are there in 3d.? in 5d.? in 8d.? in 6 $\frac{1}{4}$ d.?
2. How many pence are there in 12 far.? in 16 far.? in 20 far.?
3. How many pence are there in 2s.? in 3s.? in 5s.? in 8s.? in 4 $\frac{1}{2}$ s.?
4. How many pence are there in 1s. 3d.? in 2s. 10d.? in 5s. 8d.? in 8s. 4d.?
5. How many shillings are there in £1 12s.? in £2 10s.? in £5? in £4 8s.?
6. How many shillings are there in 24d.? in 48d.? in 30d.? in 64d.?
7. How many shillings and pence are there in 28d.? in 42d.? in 54d.? in 66d.?
8. How many pounds and shillings are there in 50s.? in 68s.? in 84s.? in 90s.? in 96s.?

Table of Weight — Avoirdupois Weight

16 drams (dr.)	= 1 ounce	(oz.)
16 ounces	= 1 pound	(lb.)
100 pounds	= 1 hundredweight	(cwt.)
20 hundredweight	= 2000 pounds = 1 ton	(T.)

The ton of 2000 lbs. is sometimes called the *short ton* to distinguish it from a ton of 2240 lbs. called a *long ton*, which is frequently used in weighing mining products. In Great Britain the long ton is used, and 1 cwt. = 112 lbs., also 14 lbs. = 1 stone.

ORAL EXERCISE

1. How many ounces are there in 2 lbs.? in 1 lb. 8 oz.? in 3 lbs. 4 oz.?
2. How many pounds are there in 32 oz.? in 20 oz.? in 48 oz.? in 40 oz.?
3. What part of a pound is 4 oz.? is 8 oz.? is 12 oz.?
4. How many tons are there in 4000 lbs.? in 3000 lbs.? in 7000 lbs.?

Example: Reduce 3 T. 6 cwt. 51 lbs. 7 oz. to ounces.

3 T. 6 cwt. 51 lbs. 7 oz.

20
60 (cwt.)

6
66 (cwt.)

100
6600 (lb.)

51
6651 (lb.)

6651 (lbs.)

16
106416 (oz.)

7
106423 oz.

Example: Reduce 147,658 oz. to T., cwt., lbs.

16)147658

100) 9228 - 10 oz.

20) 92 - 28 lbs.

4 T. - 12 cwt.

4 T. 12 cwt. 28 lbs. 10 oz.

EXERCISE

Reduce :

1. 4 T. 32 lbs. 9 oz. to ounces.
2. 5 lbs. 6 oz. to ounces.
3. 21,645 oz. to cwt., lbs., oz.
4. 2 T. 5 cwt. 4 oz. to ounces.
5. 76,385 oz. to tons, etc.
6. 3 cwt. 81 lbs. 5 oz. to oz.
7. 51,649 lbs. to tons, etc.
8. 8643 oz. to cwt., etc.

9. I bought two loads of coal, one weighing 4600 pounds and the other 4400 pounds. At \$8 per ton, what did I pay for the coal?

10. A teamster hauled a load of stone weighing $2\frac{1}{4}$ tons. Find the weight of the load in pounds.

11. A load of hay weighed 4360 pounds, and the wagon weighed 1360 pounds. Find the value of the hay at \$20 per ton.

12. A farmer sold some hogs weighing 7800 pounds at \$9.50 per hundredweight. How much money did he receive for the hogs?

13. An ice company retails ice at 40¢ per hundredweight. What does the company receive for 3 tons of ice?

14. An ice company stored 360 tons of ice during the winter. If each of its customers used on the average 1200 pounds, how many customers did the company supply?

Table of Length, or Linear Measure

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	= 1 rod (rd.)
320 rods, or 1760 yards, or 5280 feet	= 1 mile (mi.)
80 chains	(63,360 ")= 1 mile

The Dominion standard unit of length is the *yard*.

The mile used in the above table is called a *statute mile*. The geographical or nautical mile, also called a *knot*, is equal to 1.15 statute miles. The knot is used in estimating the speed of vessels.

Gunter's chain is used in measuring land. It is 22 yards in length and is divided into 100 links, each link being 7.92 inches long.

Sailors use the *fathom* (6 ft.) and *cable length* (120 fathoms) for measuring depths.

The *hand* (the breadth of the hand and thumb), used in measuring the height of horses at the shoulder, is 4 inches.

EXERCISE

1. Measure and give the length and width of the top of your desk, the length and width of your arithmetic, the width of your class room door, the width of the windows, the length and width of your class room.

2. Estimate the length of a foot and of a yard on the blackboard and then measure the distance marked to find how accurate your judgment is.

3. Estimate the length of a rod on the floor of your class room and then measure the distance marked.

4. Estimate the width of the street or road and then measure these widths.

5. How far do you live from school?

6. What building is about a mile from your school?

Note. — The pupils should make many estimates and measurements in order to develop skill in estimating short distances.

ORAL EXERCISE

1. How many feet are there in 5 yd.? in 8 yd.? in 3 yd.? 2 ft.?

2. How many inches are there in 6 ft.? in 3 ft. 4 in.? in 7 ft. 6 in.? in 2 yd.? in 2 yd. 1 ft.?
3. What part of a yard is 18 in.? 9 in.? 27 in.? 4 in.?
4. What part of a mile is 80 rd.? 240 rd.? 880 yd.?
5. How many feet are there in 48 in.? in 30 in.? in 52 in.? in 99 in.?
6. A road is a chain wide. How many feet wide is it?

EXERCISE

1. What would be the cost of picture moulding around a room 12 ft. long and 10 ft. wide, at 15¢ per foot?
2. A horse is 16 hands high. How many feet high is he?
3. A harbor is 6 fathoms 4 ft. deep. Express this depth in feet.
4. How many fathoms are there in 48 yards?
5. A class of 40 pupils bought 30 yards of ribbon for class colors to be divided equally among them. How many inches of ribbon will each pupil have?
6. How many tons of steel rails will be required for a mile of railroad, if the rails average 70 lbs. to the yard?
7. How many bolts, each 7 in. long, can be cut from a bar of iron 14 ft. in length?
8. A train runs at the rate of 60 ft. per second. What is this rate in miles per hour?
9. Find the cost of 9 yd. 2 ft. of pipe, weighing 4 lbs. to the foot, at 40¢ per pound.
10. How many feet of wire are required to build a fence 4 wires high around a lot 24 yd. wide and 32 yd. long?
11. A city block is 440 ft. long. How many blocks are there to a mile?
12. How many steps, each 2 ft. 6 in. long, will a boy take in walking $\frac{1}{2}$ mile?

Reduce :

- | | |
|------------------------------|-------------------------------|
| 1. 2 mi. 45 rd. to rods. | 5. 4562 rd. to miles. |
| 2. 84 yd. 1 ft. to inches. | 6. 17 chains to inches. |
| 3. 12 fathoms 1 ft. to feet. | 7. 145 yd. 1 ft. 6 in. to in. |
| 4. 7845 in. to yards, etc. | 8. 7689 in. to chains. |

Surface Measure, or Square Measure

Observe the outside of a box, the outside of a sheet of paper, the outside of a football, the outside of a board.

The outside of anything is called its *surface*.

How many surfaces are there on a sheet of paper? on a box? on a football?

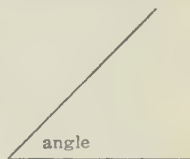
A surface has length and width only.

Find the length and width of a page of your arithmetic, of the top of your desk, of the top of the teacher's desk.

The length and width of a surface are called its *dimensions*.

Find the dimensions of the door of your class room, of one of the window panes, of the floor of your class room.

The difference in direction of two straight lines is called an *angle*.



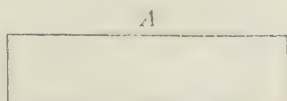
Examine the angles formed by these two straight lines.

Compare these angles with each other. Compare one of them with the angle at the corner of a page of this book.



The angle formed by two straight lines meeting in a square corner is called a *right angle*.

Examine Figure A. How many sides has it? What kind of angle is each of the four angles?



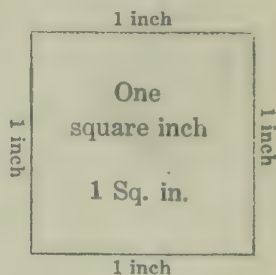
A figure enclosed by four straight lines, with each of its angles a right angle, is called a *rectangle*.

Draw rectangles with the following dimensions: 4 in. by 3 in., 5 in. by 2 in., 6 in. by 3 in.

A rectangle which is longer than it is wide is called an *oblong*.

A rectangle with all its sides equal is called a *square*.

A rectangle 1 in. long and 1 in. wide is a *square inch*, and any surface equal in area to this, no matter what its shape may be, is a *square inch*.



Draw on the blackboard a rectangle one foot long and one foot wide, or a square foot. Divide it into square inches. How many of these square inches are in one row along one side?

How many such rows of squares are in the square foot?

How many square inches are in a square foot?

The number of square inches in a square foot is found by multiplying the number of square inches in the row of squares on one side by the number of such rows.

Draw a square yard on the blackboard and divide it into square feet. How many square feet make a square yard?

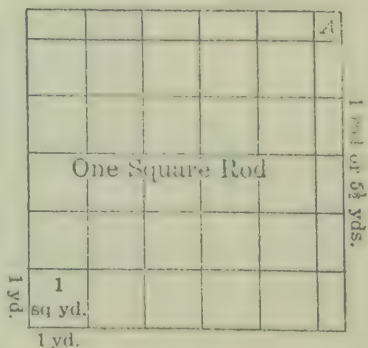
Using an inch to represent a yard, draw a square to represent a square rod.

As each inch represents a yard in length, a square inch in your drawing will represent a square yard.

How many entire squares representing square yards are in the figure?

What part of a square yard is the small square marked A?

How many oblongs are in the figure?



How many of these oblongs are equal to one full square or square yard?

To how many square yards are all the oblongs equal?

How many square yards are in the figure? How many square yards are in a square rod?

The dimensions of a surface are given in linear units. If the dimensions are given in inches, the unit of measurement of the surface is the square inch. If the dimensions are given in feet, the unit of measurement is the square foot, etc.

The distance around a surface is called the *perimeter* of the surface.

Table of Surface Measure, or Square Measure

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
4840 square yards	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

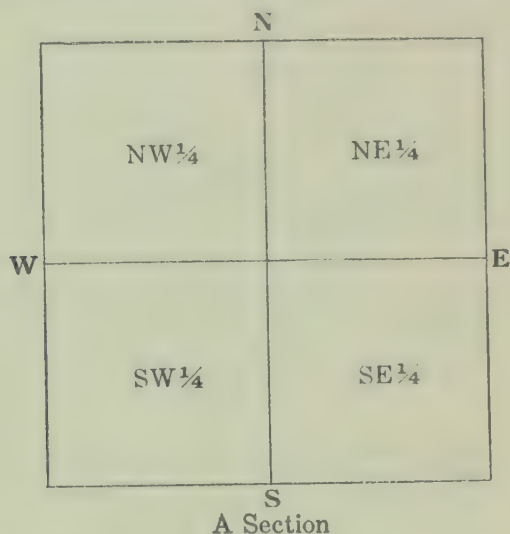
10,000 square links = 1 square chain

10 square chains = 4840 sq. yd. = 160 sq. rd. = 1 A.

Measurement of land in the Western Provinces.

A section is a tract of land 320 rods or 1 mile square and, therefore, contains 1 square mile or 640 acres. It is divided into half sections which are designated North, South, East, or West halves, or into quarter sections which are designated N.E., S.E., N.W., and S.W. quarters.

The Western Provinces have been surveyed and divided into *townships* by a system of parallel lines running east



and west and another system of parallel lines running north and south. A township is a tract of land six miles

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

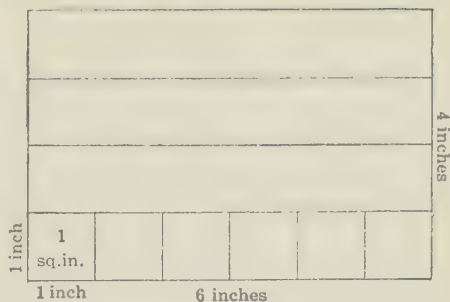
A Township

square and, therefore, contains 36 sections. These are numbered as in the figure.

To find the area of any rectangular surface.

To find the area, or number of square inches, in a rectangle 6 inches long and 4 inches wide.

How many square inches are in one row along the side of the rectangle?



How many such rows complete the rectangle?

How many square inches are in the four rows?

How many square inches are in the rectangle?

$$\begin{aligned}\text{Area of rectangle} &= 4 \times 6 \text{ sq. inches or } 4 \times 6 \times 1 \text{ sq. in.} \\ &= 24 \text{ sq. inches.}\end{aligned}$$

Rule. — The number of square units in the area of any rectangular surface is equal to the product of the number of linear units in its length and the number of linear units in its width

Draw a rectangle 8 in. by 3 in. and find its area.

ORAL EXERCISE

1. How many acres are there in a half section? in a quarter section? in three quarters of a section? in a section and a half?

2. What is the area of the floor of a room 10 ft. wide and 12 ft. long?

3. What is the area of a blackboard 4 ft. wide and 15 ft. long?

4. What is the area of a sheet of paper 6 in. wide and 12 in. long?

5. A garden is 8 rods wide and 14 rods long. What is its area?

EXERCISE

Reduce :

1. 8 sq. yd. to square inches.
2. 9 sq. yd. 10 sq. ft. to square inches.
3. 17,856 sq. in. to square feet.
4. 5 A. 40 sq. rd. to square rods.
5. 7845 sq. rd. to acres.
6. 2 quarter sections to square rods.
7. 20 sq. chains to square feet.

EXERCISE

1. A room is 12 ft. long, 10 ft. wide, and 9 ft. high. How many square feet are there in the two end walls? in the two side walls? in the ceiling? in the floor?

How many square yards of carpet will be needed to cover the floor?

2. Find the cost of painting both sides of a tight board fence 8 ft. high and 120 ft. long at 25¢ per 10 sq. ft.

3. How much will it cost to fence a rectangular farm 240 rd. long and 80 rd. wide, at 75¢ per rd.? How many acres does this farm contain?

4. How many acres are there in a rectangular field 40 rd. long and 22 rd. wide?

5. What is the shape of a quarter section? What are its dimensions?

6. A man owns the N.W. $\frac{1}{4}$ and the S. $\frac{1}{2}$ of section 4 in a certain township. How many acres has he? How much will it cost to enclose this land with a fence at 50¢ per rod?

7. What is the W. $\frac{1}{2}$ and the S. E. $\frac{1}{4}$ of section 6 worth at \$20 per acre?

8. Find the dimensions of the floor of your class room and then find the area of the floor. What unit do you use?

9. Measure and find the area of a pane of glass in the school window. What unit of measurement do you use?

EXERCISE

1. How many square feet are there in 9 square yards? in 12 square yards?

2. How many square yards are there in 48 sq. ft.? in 69 sq. ft.? in 84 sq. ft.?

3. How many square rods are there in half an acre? in a quarter of an acre?

4. Calculate the value of the land in a township at \$25 per acre.

5. How far is it by road in any township from :

(a) the south-west corner of section 1 to the north-west corner of section 13?

(b) the south-east corner of section 2 to the north-west corner of section 21?

(c) the north-west corner of section 18 to the north-east corner of section 36?

6. A rural school house is situated at the S.E. corner of section 16. How far will a child have to walk to school whose home is situated on the S.W. corner of section 2 in the same township as the school?

Cubic or Solid Measure

Examine a covered box or a brick.

Measure the length, width, and depth of the box or brick.

A body having three dimensions, length, width, and depth, is called a *solid*.

The space it occupies is called its *volume*.

Examine the faces of a covered box, of a brick. How many faces has each? What is the shape of each face?

A solid bounded by six rectangular faces is called a *rectangular solid*.

The lines in which the faces meet are called *edges*.

How many edges has a rectangular solid?

Examine a rectangular solid all of whose faces are square.

Measure the dimensions of this solid.

A rectangular solid, all of whose faces are square, or whose dimensions are equal, is called a *cube*.

A cube whose dimensions are each one inch is called an *inch cube* or a *cubic inch*, and any space equal in volume to this cube, no matter what its shape may be, is a cubic inch.

A Linear Unit



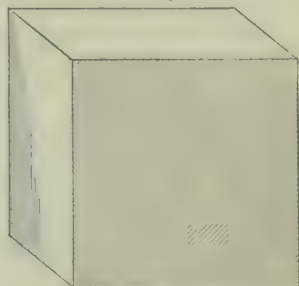
One inch

A Square Unit

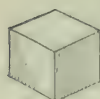


One square inch

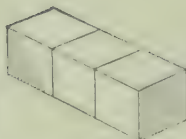
A Volume Unit



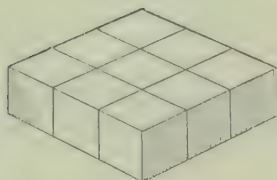
One cubic inch



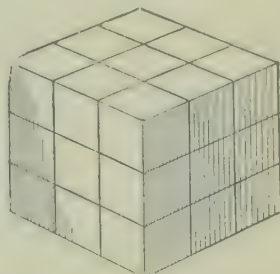
A



B



C



D

If A is one cubic inch, what is the volume of B? of C? of D?

Block B is three times as long as Block A and therefore its volume is 3×1 cubic inch.

Block C is 3 times as wide as Block B and therefore its volume is $3 \times 3 \times 1$ cubic inch.

Block D is 3 times as thick (high) as Block C and therefore its volume is $3 \times 3 \times 3 \times 1$ cubic inch or 27 cubic inches.

ORAL EXERCISE

How many cubic inches are in rectangular solids of the following dimensions :

1. (a) 4 in. long, 1 in. wide, and 1 in. thick?
(b) 4 in. long, 2 in. wide, and 1 in. thick?
(c) 4 in. long, 2 in. wide, and 3 in. thick?
(d) 5 in. long, 4 in. wide, and 2 in. thick?
(e) 6 in. long, 3 in. wide, and 4 in. thick?

2. How many cubic inches are in

- (a) a brick 8 in. long, 4 in. wide, 2 in. thick?
(b) a piece of scantling, 20 in. long, 3 in. wide, and 2 in. thick?

Find the number of cubic inches in a cube 12 in. long, 12 in. wide, and 12 in. thick. Express these dimensions in feet.

A cube whose dimensions are each 1 foot is called a *cubic foot*.

How many cubic inches are in a cubic foot?

Find the number of cubic feet in a rectangular block of ice 3 ft. long, 2 ft. wide, and 1 ft. thick.

Find the number of cubic feet in a rectangular block of stone 5 ft. long, 3 ft. wide, and 2 ft. thick.

Draw a cubic yard upon the blackboard. Divide it into cubic feet. How many cubic feet are in a cubic yard?

If the dimensions of a rectangular solid are given in inches, the unit of measure is a cubic inch, if in feet, the unit of measure is a cubic foot, etc., the unit of measure and volume being named in corresponding terms of cubic measure.

Table of Cubic, or Solid Measure

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
128 cubic feet	= 1 cord (cd.)

A cord is a pile of wood or stone equal to the volume of a rectangular solid 4 ft. wide, 4 ft. high, and 8 ft. long.

EXERCISE

Reduce :

1. 7689 cu. ft. to cords.
2. 8469 cu. in. to cu. ft.
3. 78 cu. ft. 640 cu. in. to cu. in.
4. 17 cu. yd. 12 cu. ft. to cu. in.
5. 637,684 cu. in. to cu. yd.

EXERCISE

1. A room is 12 ft. long, 10 ft. wide, and 9 ft. high. How many cubic feet of air does it contain?
2. A basement is 16 ft. long and 12 ft. wide. What is the area of the floor of the basement? If the basement is 8 ft. deep, how many cubic feet does it contain?
3. In excavating for a cellar 20 ft. long and 18 ft. wide, earth is removed to a depth of 9 ft. How many cubic feet of earth are removed? How many cubic yards are removed?

4. A concrete floor 3 in. thick is put in a basement 24 ft. by 18 ft. How many cubic yards of concrete are in the floor?
5. A coal bin is 20 ft. long, 14 ft. wide, and 6 ft. deep. If a ton of coal occupies 35 cubic feet, how many tons of coal does the bin hold?
6. How many cubic feet of water does a cistern hold which is 5 feet square and 8 feet deep?
7. How many cords of wood are in a pile of 4-foot wood, 6 feet high, and 48 feet long?
8. In building up a lawn it was necessary to fill in a space 90 ft. by 60 ft. with earth to an average depth of 1 foot. What was the cost of the earth at 55 cents per cubic yard?
9. A class room is 30 ft. long, 24 ft. wide, and 12 ft. high, and accommodates 40 pupils. How many cubic feet of air space are provided for each pupil?

Measure of Capacity

2 pints (pt.)	= 1 quart (qt.)	
4 quarts	= 1 gallon (gal.)	= 8 qt.
2 gallons	= 1 peck (pk.)	
4 pecks	= 1 bushel (bu.)	= 8 pk.

The measure of capacity is used in measuring *liquids*, water, milk, oil, alcohol, etc., and *dry articles*, grain, fruit, roots, lime, etc. In measuring liquids the peck and bushel measures are not used, but these are used in measuring dry articles. The gallon, containing 10 pounds of distilled water, is the standard measure of capacity. Its capacity is 277.274 cubic inches.

A cubic foot of water weighs 1000 oz., or $62\frac{1}{2}$ lb.

A cubic foot contains $6\frac{1}{4}$ gallons.

One gallon of pure water weighs 10 lb.

In measuring the capacity of cisterns and reservoirs, the barrel containing $31\frac{1}{2}$ gallons, or the hogshead containing 63 gallons, is used.

The following table gives the weight of a bushel of the articles named :

Wheat	60 lbs.	Beans	60 lbs.
Oats	34 lbs.	Onions	50 lbs.
Barley	48 lbs.	Beets	60 lbs.
Peas	60 lbs.	Parsnips	60 lbs.
Rye	56 lbs.	Turnips	60 lbs.
Corn	56 lbs.	Potatoes	60 lbs.
Flax seed	56 lbs.	Carrots	60 lbs.
Clover seed	60 lbs.		

ORAL EXERCISE

1. How many pints are in 4 qt. 1 pt.?
2. How many gallons are in 24 pt.? in 40 pt.? in 36 pt.?
3. In 2 gal. of milk, how many pints are there?
4. If you feed a horse 8 qt. of oats a day, how many days will 1 bu. of oats last?
5. A quart is what part of a gallon? A pint is what part of a gallon? A quart is what part of a peck? A gallon is what part of a bushel?
6. What is the weight of 4 bu. of potatoes? of 3 bu. of oats? of 2 bu. of barley?
7. How many gallons are in 1 bu. 2 pk.? in 3 pk. 2 gal.?

12 gal. 8 gal.

EXERCISE

Reduce :

1. 7684 pt. to bushels, etc.
2. 84 gal. 3 qt. to pints.
3. 36 bu. 3 qt. 1 pt. to pints.
4. 2695 pt. to gallons.
5. 8 bu. 2 pk. to quarts.
6. 200 pt. to gallons.
7. 154 gal. 1 qt. 1 pt. to pints.
8. 3685 lbs. of wheat to bu.

EXERCISE

1. Find the weight in tons of 400 bushels of potatoes.
2. How many bushels are there in 3 tons of wheat?
3. A grocer bought 6 tons of potatoes at \$20 per ton and retailed them at 75¢ per bushel. What is his profit on the sale of these potatoes?
4. A caterer buys ice cream at \$1.20 per gallon. He serves 5 dishes per quart at 10¢ per dish. What is his profit on one gallon of ice cream?
5. A family uses 2 qt. 1 pt. of milk per day. What did their milk cost for the month of November at 10¢ per quart?
6. Find the cost of 2 gal. 1 qt. of cream at 10¢ per pint.
7. A farmer feeds his horses each 4 qt. of oats three times a day. How many bushels will it take to feed a team 8 days?
8. How many gallons of water does a tank 6 ft. square and 2 ft. deep hold?

Measure of Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
12 calendar months or 365 days = 1 year (yr.)
366 days = 1 leap year

The leap years are those that contain the number 4 an exact number of times; as, 1904, 1908, 1912, 1916, etc.

But of the even hundreds, only those that contain 400 an exact number of times are leap years. The year 1900 was not a leap year, but the year 2000 will be.

The number of days in each month may be remembered by means of the following lines:

Thirty days have September,
April, June, and November;
February has twenty-eight alone—
All the rest have thirty-one;
But leap year coming once in four
February then has one day more.

The civil day begins and ends at 12 o'clock midnight.

A.M. denotes time before noon; M. denotes noon; and P.M. denotes time after noon.

100 years is a century.

ORAL EXERCISE

1. How many days are there in three weeks? in 2 weeks 6 days? in 5 weeks 3 days?
2. How many hours are there in 3 days? in 2 days 2 hours?
3. How many weeks are there in 35 days? in 84 days? in 45 days?
4. How many days are there in July, August, and September?
5. How many seconds are there in five minutes? in 2 minutes 10 seconds?
6. How many minutes are there in 120 seconds? in 360 seconds? in 90 seconds?

EXERCISE

Reduce :

1. 17 hr. 15 min. to seconds.
2. 5 da. 15 hr. 20 min. to minutes.
3. 12 hr. 35 min. 20 sec. to seconds.
4. 1 wk. 1 hr. to minutes.
5. How many days are there from Jan. 25 to Mar. 10, 1918?

Circular, or Angular Measure

Circular or angular measure is used to measure the size of circles and angles.

There are 360 degrees (360°) in the circumference of a circle and therefore 90° in a quarter of the circumference. This part of the circumference lies between the arms of a right angle at the centre of the circle.

The right angle AOB (Fig. 2) is also measured in degrees (90°).

A part of the circumference is called an *Arc*. The arc of the circumference cut off by the arms of a right angle at the centre is called a *Quadrant*.

FIG. 1

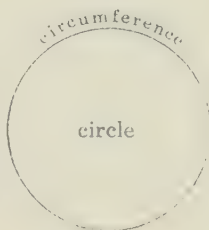


FIG. 2

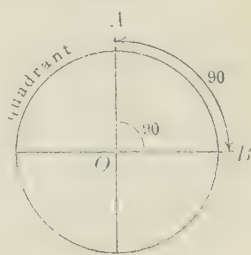


FIG. 3

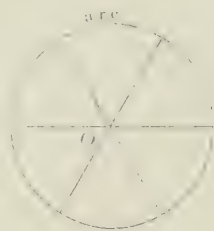


FIG. 4



In Figure 3 what part of the circumference is each arc? What part of 360° is each angle at the centre?

In Figure 4 what part of the circumference is each arc? What part of 360° is each angle at the centre?

If two lines (radii) are drawn joining the ends of an arc to the centre of the circle, there will be just as many degrees in the angle formed as there are degrees in the arc.

Table of Circular, or Angular Measure

60 seconds (") = 1 minute (')
60 minutes = 1 degree ($^\circ$)
90 degrees = 1 right angle, or quadrant
360 degrees = 1 circumference

Circular or angular measure is used to determine latitude, longitude, direction, the positions of vessels at sea, etc.

A degree of the circumference of the earth at the equator contains 60 geographical miles or 69.16 statute miles.

ORAL EXERCISE

1. How many degrees are in $\frac{1}{2}$ of a circumference? in $\frac{1}{3}$ of a circumference? in $\frac{1}{6}$ of a circumference?
2. How many degrees are between the hands of a clock at 6 o'clock? at 1 o'clock? at 3 o'clock? at 4 o'clock?
3. How many degrees are in 3 quadrants?
4. When a star is directly overhead, how many degrees is it from the western horizon?
5. How many minutes are in $1^\circ 20'$? in 3° ? in $2^\circ 10'$?

MISCELLANEOUS TABLES

Table of Units in Counting

12 things = 1 dozen (doz.)
 12 dozen = 1 gross (gro.)
 12 gross = 1 great gross
 20 things = 1 score (sco.)

Table of Paper Measure

24 sheets = 1 quire
 20 quires = 1 ream

500 sheets = 1 ream

For convenience in counting,
 500 sheets are often called a ream.

196 lbs. of flour = 1 barrel (bbl.)
 200 lbs. pork = 1 barrel

EXERCISE

1. How many sheets are there in 1 ream? in 2 quires?
 in 5 quires?

2. How many quires are there in $\frac{1}{2}$ ream? in 10 reams?
 in 48 sheets? in 72 sheets?

3. A box of paper containing 1 quire cost 60¢. What is
 the cost per sheet?

4. A stationer bought blotting paper at 80¢ per quire and
 sold it at 5¢ per sheet. What was his profit?

5. Find the cost of 240 dozen penholders at \$3.00 per
 gross.

6. Find the cost of 3 gross 9 dozen buttons at 9¢ per
 dozen.

7. A stationer bought a ream (500 sheets) of blotting
 paper 18 in. by 24 in. for \$75. He cut each sheet into small
 blotters, 4 in. by 9 in., which he sold at 3 for 5¢. What
 was his profit?

REVIEW EXERCISE

1. A hardware merchant bought $3\frac{1}{4}$ dozen handsaws at \$24 per dozen and retailed them at \$3.10 each. What was his profit on the sale of these saws?
2. In walking a five-mile race a man stepped 40 inches. How many steps did he take?
3. A ton of ice, when cut into blocks and well packed, occupies 40 cu. ft. How many tons of ice can be packed into a space 60 ft. by 40 ft. by 25 ft.?
4. How many square inches of paper will cover the surface of a block of wood in the form of a cube, each edge of which is one foot?
5. How many bricks 4 in. wide and 8 in. long will it take to pave a walk 30 ft. long and 4 ft. wide?
6. How many cubic yards of earth must be excavated to make a basement 30 ft. long, 18 ft. wide, and 8 ft. deep?
7. A cold storage plant uses 4500 lbs. of ice each week. How much will the ice cost for a year (52 weeks) at \$5 per ton?
8. In a tank which is 6 ft. long and 4 ft. wide the water is 8 in. deep. How many gallons of water are in the tank?
9. One field is 40 rd. square, another field is 80 rd. long and 20 rd. wide. What are the areas of these fields? Find the length of fence required to enclose each of these fields.
10. How many feet of picture moulding will it take to go around a room 12 ft. long and 9 ft. wide?

REVIEW EXERCISE

1. How many square yards of paving will it take to pave a street 60 ft. wide and 315 ft. long?
2. A field of wheat 80 rd. long and 40 rd. wide yields 25 bushels to the acre. At \$1.80 per bushel, find the value of the wheat from this field.
3. A rug, 4 yd. long and 3 yd. wide, is placed on the floor of a room 16 ft. long and 10 ft. wide. Find the number of square feet of floor uncovered.
4. How many square feet of wire netting are needed to enclose a chicken run 8 ft. wide and 16 ft. long with wire netting 6 ft. high?
5. How many tiles 2 inches square will be required to cover a bathroom floor 6 ft. by 8 ft.?
6. A metal ceiling is put in a hall 42 ft. \times 60 ft. Find the cost of the ceiling at \$1.20 per square yard.
7. A side of bacon weighs 9 lbs 12 oz., and a ham weighs 12 lbs. 4 oz. Find the cost of both, if bacon is sold at 48¢ per pound and ham at 40¢ per pound.
8. If you study 45 minutes at home each day your school is in operation, how many hours of home study will you do during the school year (200 days)?
9. A merchant buys pencils at \$4.80 per gross and sells them at 5¢ each. What profit will he make, if he sells 10 dozen pencils?
10. What part of the circumference of a circle is an arc of 60° ?

BILLS, ACCOUNTS, AND RECEIPTS

Bills

REGINA, Aug. 25th, 1921.

MR. JAMES BROWN,
40 Arthur Street.

Bought of JONES BROS., 245 King St.
STAPLES AND FANCY GROCERIES, FRUITS, etc.

TERMS: Cash

Telephone 3124

10 lbs. Coffee	\$.65	\$6.50
25 lbs. Sugar	.12	3.00
16 lbs. Lard	.40	6.40
5 lbs. Ham	.55	2.75
6 lbs. Cream of Wheat	.10	.60
		<hr/> \$19.25

Received payment
JONES BROS.

The above is a common form of a *bill* of goods bought at a store.

Examine the bill of goods.

- (1) Where were the goods bought?
- (2) When were the goods bought?
- (3) Who bought the goods?
- (4) Who sold the goods?
- (5) What quantities of goods were bought and at what price?
- (6) What did the whole cost?

A bill should give the following information :

- (1) The name and address of the purchaser.
- (2) The name and address of the firm from whom the goods are bought.

(3) The date of purchase.

(4) The name and amount of each article sold, the price and amount of each sale, and the total amount of all sales.

(5) When the bill is paid, the words "Received payment" or "Paid" and the firm's name should be written at the foot of the bill by some one authorized to do this.

To receipt a bill means to write or stamp the words "Received payment" or "Paid" at the foot of the bill, followed by the name of the person or firm to whom the money has been paid.

To foot a bill means to find the amount of the total sales.

EXERCISE

Make out, foot, and receipt bills for the following sales, supplying dates, names, and addresses when not given:

1. Mrs. S. Brown bought of R. Walker & Co. 10 yds. of silk at \$2.75; 12 yds. of flannel at 75 cts.; 2 pairs of gloves at \$1.50; 1 tablecloth at \$4.50; 2 doz. handkerchiefs at \$2.75.

2. James Taylor bought of Young & Bros. 5 quires of foolscap at 45 cts.; 5 exercise books at 10 cts.; 2 boxes writing paper at 65 cts.; 3 copying pencils at 15 cts.

3. George Harper bought of the Dominion Grocery Store 2 boxes of apples at \$3.25; 4 doz. eggs at 45 cts.; $1\frac{1}{2}$ bushels of potatoes at \$1.50; 6 packages of oatmeal at 20 cts.; 5 lbs. of cheese at 30 cts.

4. J. Simpson bought of the Royal Sporting Goods Store 3 baseballs at \$1.25; 2 fishing rods at \$3.45; 4 tennis balls at 45 cents; a catcher's mitt at \$5.25.

5. Robert Reid bought of P. Burns & Co. $3\frac{1}{4}$ lbs. of porter-house steak at 40 cents; 5 lbs. of bacon at 65 cents; $8\frac{1}{2}$ lbs. of pot-roast at 20 cents; leg of mutton, 7 lbs., at 35 cts.

ACCOUNTS

What is meant by charging goods at a store?

What is meant by running an account at a store?

CALGARY, Nov. 1st, 1921

MR. E. J. SIMONS,
142 Centre Street,

In Account with

THE CALGARY FURNITURE STORE, LIMITED

Wholesale and Retail Dealers in Furniture, Carpets, & House
Furnishings

Oct.	4	1 Bed, Spring, and Mattress	\$ 95 40		
		1 Dresser	38 75		
Oct.	12	1 Dressing Table	35 50		
		2 Bed Room Chairs @ \$6.50	13 00		
		1 Bed Room Rocker	7 00		
Oct.	25	1 Wilton Rug 9' × 12'	105 00		
		4 Window Shades @ \$2.15	8 60		
			\$303 25		
Oct.	26	Received on account		\$200 00	
		Balance due	\$103 25		

The above is a common form of an account.

A purchaser frequently does not pay cash for goods bought at a store, but a record of the purchases is kept by the firm. These purchases are to be paid for at the end of the month or at such time as is agreed upon. The record of the purchases and payments is called an *account*.

All records of the purchases, which to the purchaser are a debt, are called *debits* and are placed in one column of the account.

All records of money received from the purchaser on his account are called *credits* and are placed in another column of the account.

The difference between the sum of all the credits and the sum of all the debits is called the *balance* of the account.

When an account is sent to the purchaser, it is said to be an *account rendered*.

What information for the purchaser should an account rendered contain?

EXERCISE

Make out the following accounts, supplying dates, names, and addresses when not given, and balance each account:

1. Fred Drum bought of the Great West Hardware Co., Ltd., Red Deer, July 3rd, 1 kitchen range at \$65.50, 8 stove pipe sections at 35 cts.; July 15th, 3 quarts of white paint at \$1.10, 2 paint brushes at \$1.25; July 20th, 25 lbs. of nails at 10 cts., 1 hammer at 95 cts., 1 hand saw at \$1.80; July 28th, 2 hatchets at \$1.35, 20 ft. of wire netting at 15 cts.. 3 lbs. staples at 15 cts. Render this account on August 1st,

2. Chas. Smith bought of Marshall Wells Co., Sept. 3rd, 2 pairs of shoes at \$8.50, 1 suit of clothes at \$38.50; Sept. 10th, 1 rug at \$85.75, 6 kitchen chairs at \$1.50; Sept. 15th, 3 shirts at \$2.25, 4 linen handkerchiefs at 30 cts., 4 collars at 25 cts.; Sept. 28th, 1 fall overcoat \$45.00, 3 pairs of stockings at 75 cts. On Sept. 12th, Chas. Smith paid cash on account \$35. Balance the account on October 1st.

3. James Hughes bought of the West End Grocery Store, June 1st, 15 lbs. sugar at 10 cts., 3 lbs. cheese at 35 cts., 5 lbs. raisins at 25 cts.; June 5th, 3 lbs. butter at 60 cts., 5 lbs. biscuits at 20 cts., 2 cans corn at 30 cts.; June 12th, 24 lbs. flour at 6 cts., 10 lbs. wheatlets at 10 cts., 2 doz. oranges at 60 cts. Render this account on July 1st. Receipt the account showing that James Hughes paid in full the account on July 2nd.

Another method of showing that money has been paid is by a formal receipt similar to the following:

RECEIPT IN FULL OF ACCOUNT

Truro, N. S., May 11th, 1921

*Received from Samuel Jones*_____

Fifteen~~~~~ $\frac{50}{100}$ *Dollars*

in full of account.

\$ 15.50

Thomas Simpson.

RECEIPT FOR RENT

Edmonton, Alberta, May 19th, 1921

*Received from Edward Cunningham*_____

Forty-five~~~~~ $\frac{00}{100}$ *Dollars*

for rent to date.

\$ 45.00

William Reid.

EXERCISE

1. George Wright paid Thomas Thompson \$38.40 in full of account on May 30th, 1918. Write the receipt that Thomas Thompson would give.

2. Peter Duncan paid Wm. Creighton on Mar. 31st, 1921, \$125.00 for rent of store for the month of April. Write the receipt.

3. Alice Hardy paid R. Francis, her music instructor, \$8.00 on July 31st for one month's tuition. Write the receipt that R. Francis gave her.

Farm Accounts

Every farmer finds it necessary to keep accurate accounts of his business transactions. Without such accurate accounts he cannot tell whether he is carrying on his farming operations at a profit or at a loss. He may find, for instance, that certain crops that he is growing are not yielding him a profit, as he thinks, but are actually causing a loss.

In order to find out the standing of his business, a merchant takes an inventory of his stock at least once a year. The farmer does the same. A farm inventory includes the value of the land, buildings, stock, machinery, grain, hay, household effects, cash in bank, Victory bonds, money loaned, etc. The values should be based on local market values.

FARM INVENTORY

480 acres of land and buildings at \$40 per acre	\$19,200.00
4 horses, aged, at \$120 each	480.00
3 horses, 4 yr. old, at \$180 each	540.00
2 horses, yearlings, at \$80 each	160.00
6 milch cows at \$75 each	450.00
30 two-year-old steers at \$50 each	1,500.00
15 pigs at \$25 each	375.00
6 brood sows at \$35 each	210.00
120 hens at 75 ct. each	90.00
30 tons hay at \$10.00 a ton	300.00
300 bu. oats at 50 ct. per bushel	150.00
500 bu. wheat at \$1.60 per bushel	800.00
Machinery and tools	1,250.00
	<u>\$25,505.00</u>

Make out an inventory of your father's farm.

A FARMER'S MONTHLY ACCOUNT

1921			RECEIPTS	EXPENDITURES
Feb.	1	Cash in bank	\$ 540 80	\$
	4	Sold 4 tons hay at \$20	80 00	
	10	Sold 6 hogs at \$30	180 00	
	15	Paid for hired labor		30 00
	20	Sold 450 bu. barley at 90 ct.	405 00	
	23	Bought 3 milch cows at \$65		195 00
	25	Bought 6 lambs at \$12		72 00
	27	Sold 2 tons hay at \$20	40 00	
	28	Bought 1 ton bran at \$25		25 00
	28	By balance		923 80
			\$1245 80	\$1245 80

AN ACCOUNT SHOWING THE TOTAL COST OF PRODUCTION, RECEIPTS,
AND PROFIT ON 100 ACRES OF WHEAT

1921			RECEIPTS	EXPENDITURES
Apr.	15	Plowing 100 acres	\$	\$ 250 00
	20	Harrowing 100 acres		75 00
	30	Seed wheat, 150 bu. at \$2		300 00
	30	Drilling and seeding		175 00
Sep.	1	Cutting and stooking		125 00
	30	Threshing 2500 bushels		300 00
Oct.	10	Hauling to elevator		125 00
	20	Sold 2000 bushels at \$1.90	3800 00	
Nov.	1	Sold 500 bushels for seed at \$2.15	1075 00	
Dec.	15	Taxes		30 00
			4875 00	1380 00
			1380 00	
Net Profit			\$3495 00	

EXERCISE

1. Make out an account showing the net profit from a 50-acre field of oats, the cost of production and the receipts

being as follows : April 10, plowing, 12 days at \$6.50 per day ; April 15, harrowing, \$30.00, April 16, 100 bushels of seed oats at 75¢ April 25, drilling and seeding at \$1.75 per acre ; Sept. 5, cutting and stooking, \$1.75 per acre ; Oct. 10, threshing, 8¢ per bushel, yield, 65 bushels per acre ; Oct. 25, hauling to elevator, 5¢ per bushel ; Oct. 30, sold the entire crop at 70¢. per bushel.

AGGREGATES AND AVERAGES

1. Mr. Reid brought home 16 apples in one parcel and 24 in another. He divided them equally between his two boys. How many had he to divide? How many did each boy receive?

2. A boy rode 10 mi. on Monday ; 12 mi. on Tuesday ; and 17 mi. on Wednesday. How far did he ride during these days? If he had ridden the same distance each day, how far would he have gone each day?

3. Find the sum of 7, 8, 0, 4, 5, and 6, and divide the sum by the number of quantities.

In the first example, 40 apples is called the *aggregate* of 16 apples and 24 apples, and 20 apples is the *average*.

In the second example, 39 miles is the aggregate of 10 mi., 12 mi., and 17 mi., and 13 mi. is the average.

In the third example, 30 is the aggregate, and 5 is the average.

The *Aggregate* of several quantities of the same kind is their sum.

The *Average* of several quantities is that quantity which substituted for each of them will produce an aggregate equal to that of the given quantities.

EXERCISE

Find the average of :

1. 16, 18, 26, 30, 36, 42, 50, and 56.
2. 17, 0, 20, 30, 70, 100, 27, 9, and 17.
3. 120, 340, 560, 780, 320, and 840.
4. Five pupils obtained the following marks at an examination: 60, 36, 75, 21, and 80 respectively. What was their average mark?
5. There were 45 pupils at school on Monday; 43 on Tuesday; 47 on Wednesday; 45 on Thursday; and 40 on Friday. What was the average attendance for the week?
6. A man trolling caught four fish; the first weighed 12 lbs. 8 oz.; the second, 4 lbs. 10 oz.; the third, 7 lbs. 3 oz.; and the fourth, 9 lbs. 7 oz. Find their average weight.
7. The scores of a side at cricket were the following: 22, 14, 0, 16, 4, 3, 0, 18, 17, 5, and 11. Find the aggregate score and the average per man.
8. In a store the sales for one week were as follows: \$375, \$450, \$540, \$370, \$285, and \$722. Find the average sale per day.
9. A farmer sold 4 loads of wheat from a 10-acre field; the first contained 54 bu. 16 lbs.; the second, 57 bu. 37 lbs.; the third, 56 bu. 25 lbs.; and the fourth, 53 bu. 18 lbs. What was the average amount of each load and the average yield per acre?

EXERCISE

1. The average weight of seven salmon was 9 lb. 5 oz. Find their aggregate weight.
2. The average rate of a train for five hours was 27 mi. 43 rd. Find the distance travelled during the five hours.

3. A grocer sold 5 lbs. of tea at 75¢ per pound and 2 lbs. at 47¢ per pound. What was the average price per pound?

4. In a factory the foreman receives \$40 per week; of the workmen each of three receives \$30, each of five \$25, and each of eleven \$20. What is the average weekly wage per man?

5. On Monday A rode 23 mi. 1634 yd., on Tuesday, 25 mi. 625 yd., on Wednesday, 32 mi. 1347 yd., and on Thursday, 27 mi. 342 yd. How far did he ride in the four days, and what was his average daily journey?

REVIEW EXERCISE

1. A merchant's bank deposits for the week were: \$983.75, \$1185, \$789.80, \$899, \$1089.45, \$1296.85. What were the total deposits for the week?

2. The attendance at the Edmonton Fair for the week was: Tuesday 17,897, Wednesday 18,096, Thursday 18,986, Friday 21,659, Saturday 22,893. What was the total attendance during Fair week?

3. The following table gives the attendance of the eight grades of a city school for one week. Find the total attendance of each grade for the week, the total attendance of all the grades for each day, and the total attendance of all the grades for the week.

GRADE	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
I	2497	2509	2483	2518	2476
II	2183	2098	2157	2139	2096
III	1895	1874	1906	1929	1889
IV	1563	1597	1578	1609	1598
V	1288	1309	1315	1297	1276
VI	1037	1084	998	979	1018
VII	865	847	892	876	859
VIII	605	596	619	587	574

4. A family's expenses for a year were as follows: food \$497.25, clothing \$286, fuel \$129.45, light and water \$36.80, taxes and insurance \$357.65, rent \$420, medical fees \$97.50, travelling expenses \$198.75, other expenses \$89.60. Find the total yearly expenses.

5. A young man earns \$85 per month. He pays \$28 per month for room and board. His clothing for the year costs him \$128.50. His other expenses for the year amount to \$87.75. How much does he save in a year?

6. The paper used in a club costs \$7 per thousand sheets and the envelopes \$3 per thousand. Find the cost of sending 100 invitations, each requiring a sheet of paper, an envelope, and a 2-cent stamp.

7. A grocer buys canned fruit at the rate of \$7.20 per case of 24 cans. He retails this fruit at 45¢ per can. How much does he gain on the sale of 10 cases?

8. Find the area of a path 6 ft. wide all around the inside of a garden 24 yd. long by 16 yd. wide.

9. A milkman supplies 40 customers with milk. Each customer takes on an average 1 quart 1 pint of milk daily. How many gallons of milk does he sell in a week?

10. My watch gained 1 min. 15 sec. a day during the month of November. What was the difference between my time and the correct time at the end of the month?

11. A field containing 5 acres is divided into lots, each 5 rd. frontage and 20 rd. deep. How many lots are there?

12. What will it cost to sod a lawn 90 ft. long and 21 ft. wide at 25¢ per square yard?

13. The charge for sending a telegram to a certain place is 40¢ for 10 words and 5¢ for each additional word. What does a telegram of 24 words cost?

14. A man bought a quantity of coal for \$250 and, by retailing it at \$5.75 per ton, gained \$37.50. How many tons of coal did he buy?

15. How many cubic feet of concrete are in a sidewalk 200 ft. long, 6 ft. wide, if the concrete is 4 in. thick?

16. How many square yards are in the walls of a room 30 ft. long, 24 ft. wide, and 9 ft. high?

17. At 65 cents per hour, what are a man's weekly wages, if he works 5 hours on Saturday and 8 hours on each of the other five days?

18. A lawn is 10 yards wide. How many times would a person go back and forth in cutting the grass with a lawn mower that cuts a strip 15 inches wide?

19. In walking around the promenade deck of a ship a man walks 660 ft. Find the number of miles he walks in going around the deck 24 times.

20. A person riding on a train counted 40 telegraph poles every minute. If the poles are 2 rods apart, how many miles per hour was the train travelling?

21. The municipal council built a roadway 4 miles long. Find the cost of the roadway, if one yard of road costs \$1.75.

22. How much wire is left when 46 yd. 1 ft. 10 in. are taken from a coil containing 60 yd. 1 ft. 3 in.?

23. Find the cost of linoleum required to cover the floor of a kitchen 14 ft. long and 13 ft. 6 in. wide at 75¢ per square yard.

24. Find the cost of 10 planks each 16 ft. long, 15 in. wide, and 3 in. thick at \$50 per M.

25. If 40 cu. ft. of coal weighs a ton, how many tons are there in a vein 200 yd. long, 180 yd. wide, and 5 ft. thick?

26. How many bushels of wheat worth \$1.75 per bushel must be grown on an acre to equal in value a crop of 50 bushels per acre of oats worth 70¢ per bushel?

27. If it requires 12 qt. of oats per day to feed a horse, how many days will 6 bu. 3 pk. feed a team of horses?

28. Make out bills, footing and receipting each, for the following purchases supplying dates, names, and addresses:

(a) $3\frac{1}{2}$ lbs. of steak at 30¢; $14\frac{1}{2}$ lbs. of fish at 20¢; 1 turkey, 8 lbs., at 45¢; leg of mutton, 5 lbs., at 40¢.

(b) 7 yd. cotton at 15¢; 6 handkerchiefs at 25¢; 3 pairs gloves at \$1.25; 8 yd. muslin at 35¢; 12 yd. flannel at 25¢.

(c) 4 lbs. coffee at 55¢; 6 lbs. tea at 75¢; 7 lbs. lard at 40¢; $3\frac{1}{2}$ lbs. butter at 60¢; $8\frac{1}{2}$ lbs. cheese at 30¢; 4 doz. eggs at 45¢; $\frac{1}{2}$ gal. coal oil at 40¢.

29. A farmer sold 4 loads of wheat, the average weight of each load being 1740 lbs., at \$1.85 per bushel. How much money did he receive for the four loads?

30. Find the total cost of the following:

2640 lbs. of wheat at \$2.10 per bushel.

2210 lbs. of oats at 70¢ per bushel.

3600 lbs. of barley at 95¢ per bushel.

3960 lbs. of potatoes at \$1.75 per bushel.

7380 lbs. of turnips at 45¢ per bushel.

31. An elevator holds 2,400,000 bushels of wheat. Find in tons the capacity of the elevator.

32. A dealer buys lead pencils at \$6.50 per gross and sells them at 10 cents each. How much does he make on each gross of pencils?

33. A schoolroom is 30 ft. long, 24 ft. wide, and 10 ft. high, and accommodates 36 pupils. How many cubic feet of air space does this provide for each pupil?

34. A field $\frac{1}{2}$ mile long and 40 rods wide is sowed in wheat. The average yield from this field was 30 bushels per acre. At \$1.75 per bushel find the value of the wheat crop from this field.

Accuracy and Time Tests

1. Find how many of the following examples you can work in 10 minutes ; in 5 minutes.

Add : <i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
14,286	146,962	28,749	47,968
7,345	776	56,397	52,376
22,654	8,574	74,863	84,583
90,837	6,942	86,789	98,767
65,294	38,479	65,921	21,945
9,763	265,837	39,466	42,649
896	49,768	42,735	76,878
		<u>98,648</u>	89,536
			<u>34,685</u>

<i>e</i>	<i>f</i>	<i>g</i>
\$7354.95	\$14,708.85	\$6495.87
78.64	86.48	9639.28
965.80	9,827.75	8769.75
2796.09	86,494.63	7424.63
12.75	897.28	6985.85
9.89	68.74	4396.29
487.63	7,493.86	8539.27
8594.15	29,847.95	5864.86
88.50	9.55	3487.25
<u>495.27</u>	<u>784.69</u>	

(h) $68 + 75 + 6937 + 948 + 8 + 79,486.$

(i) $809 + 78 + 6938 + 54,769 + 69 + 80,392.$

(j) $4968 + 875 + 6387 + 2547 + 88 + 9 + 69,848.$

(k) $80,759 + 79,634 + 4976 + 98 + 675 + 8943 + 77.$

2. Subtract:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
51,384,276	127,459,106	103,514,263	80,360,217
<u>25,839,287</u>	<u>38,649,237</u>	<u>84,395,085</u>	<u>53,982,719</u>
<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
134,582,604	82,861,700	10,085,302	6,400,075
<u>74,893,847</u>	<u>63,576,832</u>	<u>7,497,638</u>	<u>2,734,886</u>

3. Multiply. Score 5 for each correct answer and find what score you can make in 5 minutes; in 10 minutes.

<i>a.</i> 387 <u>495</u>	<i>b.</i> 429 <u>524</u>	<i>c.</i> 857 <u>294</u>	<i>d.</i> 492 <u>956</u>	<i>e.</i> 649 <u>758</u>
<i>f.</i> 976 <u>483</u>	<i>g.</i> 769 <u>895</u>	<i>h.</i> 8765 <u>4528</u>	<i>i.</i> 8219 <u>7863</u>	<i>j.</i> 98,347 <u>864</u>
<i>k.</i> 79,486 <u>795</u>	<i>l.</i> 683,947 <u>487</u>	<i>m.</i> \$500.64 <u>405</u>	<i>n.</i> \$876.97 <u>648</u>	
<i>o.</i> \$945.65 <u>749</u>	<i>p.</i> \$876.89 <u>658</u>	<i>q.</i> \$498.95 <u>976</u>	<i>r.</i> \$614.92 <u>809</u>	
<i>s.</i> \$975.27 <u>345</u>	<i>t.</i> 86,563 <u>7,090</u>	<i>u.</i> 678,964 <u>8,006</u>	<i>v.</i> 8,093,848 <u>706</u>	

4. Divide. Score 10 for each correct answer and find what score you can make in 5 minutes; in 10 minutes.

<i>a.</i> 14,758 ÷ 59	<i>h.</i> 214,985 ÷ 606	<i>o.</i> \$14,027.65 ÷ 349
<i>b.</i> 28,639 ÷ 68	<i>i.</i> 943,876 ÷ 573	<i>p.</i> \$40,050.06 ÷ 563
<i>c.</i> 20,273 ÷ 97	<i>j.</i> 389,647 ÷ 859	<i>q.</i> \$70,987.85 ÷ 877
<i>d.</i> 68,258 ÷ 48	<i>k.</i> 409,062 ÷ 685	<i>r.</i> \$58,063.74 ÷ 496
<i>e.</i> 843,962 ÷ 37	<i>l.</i> 198,342 ÷ 784	<i>s.</i> \$20,834.35 ÷ 635
<i>f.</i> 479,628 ÷ 56	<i>m.</i> 586,438 ÷ 982	<i>t.</i> \$35,964.28 ÷ 438
<i>g.</i> 563,849 ÷ 87	<i>n.</i> 674,283 ÷ 839	<i>u.</i> \$64,283.65 ÷ 98

ANSWERS

Exercise. Page 129. 1. \$2420.50. 2. \$1612.75. 3. \$78.75.
4. 71 coins. 5. \$2. 6. 33 hours. 7. \$1.35. 8. \$14.15.

Exercise. Page 134. 1. \$828.75. 2. 9916 bushels.
3. \$2760. 4. 1824 miles. 5. \$195.00. 6. \$157.50. 7. 14,402 lbs.

Exercise. Page 134. 1. 454,560 sheets.
2. 195,559 yards. 3. \$6125. 4. 1653 yards. 5. 3,915,648 lbs.
6. \$1,228,275. 7. 263,952 apples. 8. 61,275 yards.

Exercise. Page 135. 1. \$1,246,420. 2. \$3,926,000. 3. \$17,982.
4. 262,800 barrels. 5. \$7,932,245. 6. 89,784 yards. 7. 7,344 miles.
8. \$631.80.

Exercise. Page 140. 1. 1,412 cattle. 2. \$4938. 3. \$18,246.
4. \$1350. 5. 2427 turkeys. 6. 125 bushels. 7. 8 days. 8. 1090
feet. 9. \$75. 10. 36 bushels.

Exercise. Page 141. 1. 14 months. 2. 367 acres. 3. \$405.
4. \$3380. 5. 15 weeks. 6. \$78. 7. 1650 barrels. 8. 12 months.

Exercise. Page 141. 1. \$2.40. 2. 54 cents. 3. \$56. 4. \$96.
5. \$100. 6. \$1.25. 7. \$28.

Exercise. Page 147. 3. $\frac{1}{4}$ yard. 4. $2\frac{1}{2}$ feet. 5. $6\frac{1}{2}$ hours.
6. $2\frac{1}{4}$ feet. 7. $1\frac{1}{4}$ yards. 8. $4\frac{1}{4}$ yards. 9. \$2 $\frac{1}{4}$. 10. $\frac{1}{8}$. 11. \$1.05;
\$1.95; \$2.00; \$2.20; \$3.40. 12. 110 yards.

Exercise. Page 153. 4. 55 cents. 5. 50 cents. 6. \$3.77..
7. \$8.75. 8. \$4.50. 9. \$2.82.

Exercise. Page 153. 1. \$6.55. 2. a. \$61.20., b. \$32.80. Total
\$94. 3. 112 lbs. 4. 80 acres. 5. 385 acres. 6. 60 cents.
7. 3 gallons. 8. 45 tons. 9. \$7000. 10. \$340.

Exercise. Page 154. 1. 708. 2. Farm is worth \$250 more.
3. 25 yards. 4. \$990. 5. \$15 each. 6. 15.789. 7. 525 gallons.
8. \$575. 9. \$6362. 10. 420 bushels.

Exercise. Page 155. 1. \$1368. 2. \$22,250. 3. 21 eggs.
 4. \$2.00. 5. \$6982.50. 6. \$327.75. 7. \$420. 8. 454,560 sheets.
 9. 491,103 apples. 10. 418,175 yards.

Exercise. Page 156. 1. \$5673.75. 2. Mixture is worth \$83.85.
 Gain \$25.35. 3. \$631.80. 4. 294,000 lbs. 5. \$4,710,000. 6. \$542.
 7. \$302.65. 8. 25,200 lbs. 9. \$1160. 10. \$7.85.

Exercise. Page 157. 1. \$2500. 2. 10,008 inches. 3. \$81.90.
 4. \$199.50. 5. \$1020. 6. \$735. 7. 60 ten-cent pieces, 200 five-cent pieces.
 8. 49 cents. 9. \$2.10. 10. \$5.45.

Exercise. Page 158. 1. 25 cents. 2. 43 days. 3. 26 days.
 4. \$45. 5. \$3.50. 6. 129 years. 7. 2075 barrels. 8. 13 dozen.
 9. 108 yards. 10. 18 lbs.

Exercise. Page 159. 1. 35 miles. 2. 12 days. 3. \$12.
 4. 2 quarts. 5. \$220.50. 6. \$14. 7. \$4.75. 8. 20 horses, 9 sheep.
 9. 9 months. 10. 1250 boxes.

Exercise. Page 170. 5. 8. 6. \$3.60 per bbl. 7. 42 cents.
 8. \$15. 9. \$2.88. 10. 5 tubs. 11. $28\frac{1}{2}$ cents. 12. 20,160.
 13. 3360 bush.

Exercise. Page 174. 19. Length 24 feet, width 12 feet. 20. \$36;
 \$24. 21. 72 times.

Exercise. Page 188. 1. $\$ \frac{7}{8}$. 2. $\$1\frac{3}{4}$. 3. 9. 4. 13 eighths.
 5. $16\frac{1}{2}$ gal. 6. 65 mi. 7. $55\frac{2}{3}$ bu. 8. $18\frac{2}{5}$ ft., 13 ft. 9. $714\frac{2}{7}$ rd.
 10. 440 poles. 11. 46. 12. $33\frac{1}{3}$ hr.; 4 boxes.

Exercise. Page 192. 1. $19\frac{1}{2}$ bush. 2. $39\frac{2}{4}$ lbs. 3. $53\frac{17}{20}$.
 8. $69\frac{10}{30}$. 9. $81\frac{7}{12}$ mi. 10. $1834\frac{5}{8}$ bu.

Exercise. Page 193. 1. 16 oz. 2. $3\frac{1}{3}$ yd. 3. 1320 yd., 1906 $\frac{2}{3}$
 yd., 2566 $\frac{2}{3}$ yd. 4. $2\frac{1}{4}$ A. 5. $38\frac{1}{30}$ sec. 6. $39\frac{5}{24}$ T. 7. $13\frac{5}{12}$ in.
 8. $41\frac{4}{120}$ mi.) 9. $122\frac{3}{120}$ lb. 10. $401\frac{4}{60}$ mi.

Exercise. Page 194. 1. $\frac{17}{40}$. 2. $3\frac{1}{3}$ T. 3. $\frac{8}{9}$. 4. $21\frac{4}{60}$ gal.
 5. $89\frac{3}{120}$ mi., $5\frac{8}{120}$ mi. 6. $81\frac{1}{6}$ ft., $5\frac{1}{12}$ ft. 7. $110\frac{9}{120}$ lb.
 8. $68\frac{3}{120}$. 9. $71\frac{1}{40}$ mi. 10. $5371\frac{3}{8}$ bu. 11. $285\frac{3}{840}$ A.

12. $1113\frac{1}{4}$ yd. 13. $85\frac{11}{120}$ T. 14. $26\frac{5}{14}$ lbs. 15. $23\frac{17}{120}$ sec.,
 $86\frac{10}{120}$ sec. 16. $4\frac{1}{3}$ ft. 17. $18\frac{5}{6}$ in. 18. $555\frac{5}{840}$ T. 19. 73,
 $88\frac{7}{12}$, $117\frac{5}{12}$. 20. $764\frac{4}{7}$ A.

Exercise. Page 205. 1. 240 *Sacks*. 2. 384 *bls.* 3. \$41.66 $\frac{2}{3}$. 4. 1 $\frac{3}{4}$ days. 5. 147 $\frac{1}{2}$ yd. 6. 34 $\frac{25}{56}$ ft. 7. 2732 $\frac{8}{35}$ bu. 8. 41 $\frac{1}{18}$ miles. 9. 29 $\frac{1}{2}$ bu. 10. 30 lb.

Exercise. Page 218. 1. 802.6 miles. 2. 608.56 miles. 3. 1441.2 miles. 4. 56.12 inches. 5. 13.877 inches. 6. 3097.71 bushels. 7. 40.85 tons. 8. 1709.48 acres. 9. 193.76 tons. 10. 215.36 lb.

Exercise. Page 221. 1. 26.4 degrees. 2. 27.55 tons. 3. 10.73 inches. 4. 40.3 inches. 5. 2.67 inches. 6. 832.4 miles. 7. 479.8 miles. 8. 1411.6 miles. 9. Jersey gave 1.453 lbs. more than Ayrshire; Jersey gave 1.213 lbs. more than Holstein; Holstein gave 0.24 lbs. more than Ayrshire. 10. 24.8 lb.

Exercise. Page 222. 1. 47.575. 2. 1006.754. 3. 334.3925. 4. 86.1942. 5. 357.7493. 6. 430 acres. 7. 111.95 tons. 8. 10.09 miles. 9. 77.042 miles. 10. 1.2 inches more in Edmonton.

Exercise. Page 226. 1. 704.718 miles 2. 875.875 miles. 3. 29.0598 ft. 4. 8000 lbs. 5. 242.1875 miles 6. 382.5498 lb. \$202.75. 7. \$157.43. 8. \$233.31. 9. \$21386.007. 10. 126 tons; \$2992.50.

Exercise. Page 234. 1. 1.315 inches. 2. 14.146 inches. 3. 955.94 miles. 4. 3.846 lbs. 5. 4.128 lbs. 6. 2635 bu. 7. 3870 bu. 8. 128 miles. 9. 3508000. 10. 85100. 11. 4133.64 bu. 12. \$555.775.

Exercise. Page 242. 9. \$36. 10. 4500 lbs. 11. \$30. 12. \$741. 13. \$24. 14. 600.

Exercise. Page 244. 1. \$6.60. 2. 5 feet 4 inches. 3. 40 feet. 4. 24 fathoms. 5. 27 inches. 6. 61 tons 12 cwt. 7. 24 bolts. 8. 40 miles 1600 yards. 9. \$46.40. 10. 1344 feet. 11. 12 blocks. 12. 1056 steps.

Exercise. Page 250. 1. Ends 180 square feet; walls 216 square feet. Ceiling and floor 120 sq. ft. each; 13 $\frac{1}{2}$ yards of carpet. 2. \$48. 3. \$480., 120 acres. 4. 5 $\frac{1}{2}$ acres. 5. Length $\frac{1}{2}$ mile, width $\frac{1}{2}$ mile. 6. 480 acres, \$640. 7. \$9600.

Exercise. Page 254. 1. 1080 cu. ft. 2. Area 192 sq. ft.; Volume 1536 cu. ft. 3. 3240 cu. ft.; 120 cu. yd. 4. 1 cu. yd. 5. 48 tons. 6. 200 cu. ft. 7. 9 cords. 8. \$110. 9. 216 cu. ft.

Exercise. Page 257. 1. 12 tons. 2. 100 bushels. 3. \$30.
4. 80 cents. 5. \$7.50. 6. \$1.80. 7. 6 bushels. 8. 450 gallons.

Exercise. Page 262. 1. \$42.90. 2. 7920 steps. 3. 1500 tons.
4. 864 sq. in. 5. 540 bricks. 6. 160 cu. yd. 7. \$585. 8. 100
gallons. 9. Areas equal: 1st field, 160 rods; 2d. field, 200 rods. 10. 42
feet.

Exercise. Page 263. 1. 2100 sq. yd. 2. \$900. 3. 52 sq. ft.
4. 288 sq. ft. 5. 1728 tiles. 6. \$336. 7. \$9.58. 8. 150 hours.
9. \$2. 10. $\frac{1}{6}$.

Exercise. Page 265. 1. \$49.50. 2. \$4.50. 3. \$13.25.
4. \$17.70. 5. \$8.70.

Exercise. Page 267. 1. \$85.50. 2. Balance \$171.45. 3. \$10.84.

Exercise. Page 270. 1. \$1494.50.

Exercise. Page 272. 1. $34\frac{1}{4}$. 2. $32\frac{2}{9}$. 3. $493\frac{1}{2}$.
4. $54\frac{2}{5}$. 5. 44. 6. 8 lbs. 7 oz. 7. Aggregate 110; average 10.
8. \$457. 9. Average weight 55 bu. 24 lb. Average yield 22 bu.
 $9\frac{3}{5}$ lb.

Exercise. Page 272. 1. 65 lbs. 3 oz. 2. 135 mi. 215 rd.
3. 67 cents. 4. \$23.75. 5. 109 mi. 428 yds.; 27 mi. 547 yds.

Exercise. Page 273. 5. \$467.75. 6. \$3. 7. \$36. 8. 144 sq.
yd. 9. 105 gal. 10. 374 minutes. 11. 8 lots. 12. \$52.50.
13. \$1.10. 14. 50 tons. 15. 400 cu. ft. 16. 108 sq. yd.
17. \$29.25. 18. 24 times. 19. 3 miles. 20. 15 miles. 21. \$12,320
22. 13 yd. 2 ft. 5 in. 23. \$15.75. 24. \$30.00. 25. 40,500 tons.
26. 20 bushels. 27. 9 days. 28. (a) \$9.55; (b) \$12.10; (c) \$16.15
29. \$214.60. 30. \$380. 31. 72,000 tons. 32. \$7.90.
33. 200 cu. ft. 34. \$2100.

$$\begin{array}{r} 5 \frac{4}{3} \\ \hline 6 \end{array}$$

$$\begin{array}{r} 140 \\ 3-5- \\ \hline \end{array}$$

